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A Curious Cause of Fire.—A singular case of fire, which is of special interest to the fire underwriters, occurred recently in Philadelphia. About 10 o'clock one evening smoke was noticed in a house, an alarm was turned in, and the firemen found a blaze between the ceiling of the first floor and the floor of the second. It was burning briskly, but was soon extinguished. The chief of the department, struck with the singularity of the fire, ripped up the boards over the place were the fire was seen and discovered a second fire on the top of a timber through which a gas pipe was cut. This fire was put out and the investigation proceeded. The chief suspected that electricity might have something to do with the case, but the owner assured him that he had no electric wire in the house. While they were talking smoke was seen coming from a closet in the bath room on the same floor. The chief thought at first that this was confined to smoke, but it soon proved to be coming from a third fire. This was quickly got under. The case was becoming so mysterious that it was decided to rip up the ceilings in the vicinity of the fires. After the firemen had been working fifteen minutes they came on a fourth fire near a gas pipe, which was found to be red-hot. This was plainly the cause of the fire. Next day there was another alarm, this time in the cellar, near the entrance of the gas pipe from the street. An examination showed that the gas pipe was partially melted at this point. The chief, being then satisfied that electricity was it some way responsible, called in the electrical inspectors. The origin of the fires was then explained. Although there was not a wire in the house, some electric feed wires ran up the street in front. The insulation on those conductors had become impaired, current had leaked into the containing iron tube, and passed along the tube to where it rested on an iron gas pipe, which ran into the house. The current followed this pipe into the dwelling and grounded on the water pipes.

End of a Notable Ticket Scalping Case.—The supreme court has denied a rehearing in the somewhat celebrated case of the Chicago & Alton Railroad vs. Mulford. Suit was originally brought against the railroad company by Mulford & McKenzie, ticket brokers, to recover the value of certain coupons issued by the Alton which were not honored. The circuit court at Chicago, rendered a judgment in favor of the plaintiffs for $10,800. The defendents appealed the case and it went before the appellate court, which unanimously confirmed the opinion of the lower court. It was then appealed to the supreme court, and the decision of the lower courts was reversed by the higher court. The plaintiffs filed a petition for a re-hearing, but this has been denied, ending the litigation. The facts briefly stated are as follows: In 1880 the firm bought from the Chicago & Alton tickets from Kansas City over its line to Bloomington, Ill., and thence via the Lake Erie & Western to Lafayette, Ind., Toledo, Ohio and other eastern points. These tickets were purchased during the war between the Wabash and Alton. When the rates were partly restored the firm began selling the tickets, and finally disposed of all the coupons from Kansas City to Bloomington. In the meantime the Lake Erie & Western had gone into the hands of a receiver, and at the solicitation of the company the United States court ordered all railroad tickets issued prior to the bankruptcy to be dishonored. Mulford & McKenzie then filed a suit against the Chicago & Alton Co. for the value of the coupons over the Lake Erie & Western.

Facts Regarding Divers.—The dress of a fully equipped diver weighs 169½ lbs., and costs about $500. First of all comes 8½ lbs. of thick underclothing; then follows the dress itself, weighing 14 lbs.; boots, 32 lbs., monstrous things with leaden soles; breast and back weights, 80 lbs.; and, lastly, the helmet, which weighs 35 lbs. When the hull of the Great Eastern was cleaned by divers as she was being loaded with the cable for the Indian submarine telegraph the contract price for the work was £1,800, and it was completed in six weeks by twelve divers. The incrustation on her bottom was more than a foot thick, and after it was removed she lifted fully two inches. The greatest depth at which a diver may safely work is 150 ft. There have been, however, rare instances of diving to 204 ft., and sustaining a pressure of 88½ lbs. on every square inch on the body of the diver. Diving was first incepted by the action of the elephant in crossing a deep river, when he swims beneath the water, elevating his trunk, by which method he breathes. The work of a diver consists in recovering lost articles, and slinging them in such a manner that they can be easily hauled up, cleaning and coppering ships' bottoms, cleaning propellers, and communicating by slate and voice. When able to work at a depth of 120 ft. a diver is considered fully qualified. The flag ships in the British navy carry eight divers, and the cruisers four each, fully equipped.—Strand Magazine.

Decline of the Natural Gas Supply.—Natural gas is fast going. Mr. J. D. Weeks has just made a report on the supply and its decline for the national labor bureau in which it appears that the supply has fallen a half in seven years. In 1888 the value of the gas produced was $22,629,875. In 1895 it was $13,006,650. In Pennsylvania the fall has been much greater than in Ohio and Indiana. In 1888 the gas produced in Pennsylvania was worth $19,282,375; in 1895 it was $5,852,000. The decrease has been less rapid since 1891, owing to the general introduction of meters, but it has gone on at the rate of about 5 per cent a year. As the product shrinks rapidly when pressure falls it may not be over 10 or 15 years before very little gas is produced. The waste of the past ten years will be looked upon as egregious folly. Mr. Weeks points out that when the number of wells is regulated and restricted, the yield of gas lasts longer. This certainly suggests the wisdom of legislation and inspection on this subject.

A Suggestion for Mr. Bryan.—The Boston News Bureau publishes the following as the probable farewell bulletin of W. J. Bryan as a presidential candidate: "The undersigned resumes the practice of law in the city of Lincoln, Neb., which he relinquished on embarking in another line of business four months ago. If he can hereafter say anything or do anything that will tend to heartily unite the American people he will gladly do so." The foregoing card is a paraphrase, substantially, of the one signed by Horace Greeley and published in the New York Tribune, Nov. 7, 1872, after he had received the election returns giving Grant and Wilson 286 electoral votes, against 47 electoral votes for Greeley and Brown. This for him sad ending of a triumphal march through the country broke his heart and he died before the electoral vote was counted. Bryan will not die, being a younger man of splendid physique, but he will be wiser then, and know more of the temper of the American people than he now does.

The Redemption of the Zuider Zee.—The indefatigable Dutchman has had to battle with the North Sea to get his land; and it must be allowed that he has been remarkably successful in adding to his territory by encroachments on the water. Not fully contented with the reprisals he has already made, he is about to inaugurate another extensive appropriation of Neptune's domain, by the inclusion of the greater part of the area covered by the Zuider Zee. The scheme whereby this is to be effected, although embracing a work of enormous magnitude, is simple enough in its conception. It is merely the construction of a huge dike across the narrow part of the Zee, thus joining the peninsula near the Island of Urk, in North Holland, to Kempen, in Friesland. That being accomplished, nothing remains but to pump the water out of the lake thus formed, and to convert this vast area, some 1,500 square miles in extent, into arable land. It is a bold undertaking, estimated to cost 26 millions sterling; but the land recovered would be worth some 27 millions. The embankment, which is to be a hundred feet wide at the base, is expected to require a period of nine years for its formation, and it may be a long time after that before the land thus acquired can be utilized and become profitable. If the proposal should be carried out, it will form one of the greatest engineering works of modern times.

Petroleum Fuel in the Navy.—The report recently submitted to the navy department by a board of naval engineers designated about a year ago by Chief Engineer G. W. Mellville, engineer in chief of the Bureau of Steam Engineering, United States navy, to experiment with an invention for the purpose of using petroleum as a fuel in the naval service, states that the experiments were entirely successful. The tests of a new fuel for steam vessels are cheapness, ease of operation, economy of room, and general efficiency. The board reports favorably upon the Zerbe apparatus in respect of all these points. The evaporation was found to be 17, 18, 19, and 20 pounds of water, at various pressures, to one pound of oil, or more than double that of the best coal with the same boiler. The pressure of steam was constant, which means economy of fuel and equalization of pressure upon the machinery. There were no ashes nor dirt to injure the fine mechanism, and no stokers were required. The fuel can be put on board at sea. Other important advantages are claimed for the new device. It is said to be as safe as coal and to occupy so much less room that a vessel having a steaming radius of 1,000 miles with coal would be able to steam 2,000 miles with the same bulk of petroleum. The waste space now devoted to water ballast forms, it is said, a perfect petroleum bunker, to be reoccupied by water as the oil is consumed. For the commercial marine, this would mean a cubic foot available for freight for every cubic foot of coal bunking space saved. The equipment of the fire-box constitutes the most important departure in the new invention. The grate bars of the ordinary furnace are utilized for the purpose of forming thereon a brick bed. This bed is composed of bricks, which have grooves partially across one face. They are laid on the grate bars at an angle of 45 degrees, thereby forming air ducts over the entire surface of the bed, and also making a corrugated surface. Instead of injecting the oil through round injectors, a fan-shaped spray is distributed over this foraminous bed, which bursts into flame on striking the bed, heating up the latter to incandescence. The air passing through the grooves and uniting with the carbonic gases generated by the contact of the oil spray with the heated brick, makes a perfect oxy-hydrogen flame. For injecting the oil and breaking it up compressed air is utilized.

Heavier Locomotives.—With all the improvements in motive power that the Pennsylvania Railroad has made in the past fifteen years, and notwithstanding the fact that several new classes of engines have been built during the past two years, the motive power officials are not yet satisfied, and they generally admit that regardless of the future possibilities of electricity the perfect steam locomotive is yet to come. Chief of Motive Power Theo. N. Ely in a recent communication discusses at length the modern locomotive and particularly the recent types introduced on the Pennsylvania Railroad and its principal connections, and he is not slow or backward about pointing out the radical weaknesses which cannot be remedied. He admits that the Belpaire boiler is not the best for steam, but points to its superior strength, giving it a desideratum which more than counteracts its new defects, and he says that the boiler which is to replace the Belpaire on the Pennsylvania has not yet been invented. As the cars, the trains and the traffic are increasing on a nearly equal ratio, and the increase is phenomenally rapid, the weight of trains constantly exceeds the capacity of the engines and the greater necessity for economic operation adds to the perplexing problem that confronts the motive power officials. The Pennsylvania will continue therefore to experiment with new designs, and within the dimensions to which they are now restricted by tunnels and bridges they will keep on adding to the weight and strength of the locomotives till the power and speed necessary to meet present and future requirements is accomplished in the development of a great machine which will dwarf even those now in use. Other companies whose roads have a much larger clearance in those places, have already adopted immense engines, and by means of the extended wagon top boiler they have built machines which are too heavy and too fast for the condition of the tracks, and now they are commencing to do what the Pennsylvania did years ago—apply stone ballast, lay heavier rails and build stronger bridges, and adopt block signal systems to avoid extreme danger in fast schedules.—[Coal and Coke.

Care Necessary.—Judge Caldwell, in the United States circuit court of appeals at St. Louis, has handed down a decision which is of vital importance to all railroads. It was in the case of M. E. Bronson against the receivers of the Northern Pacific Railroad. Mr. Bronson is a citizen of St. Paul, Minn. He took a trip over the Northern Pacific. The train was vestibuled, and while passing from the rear sleeper, which he occupied, to the front coach, the train gave a lurch. Mr. Bronson fell against one of the outside vestibule doors, which had not been fastened, and he fell out. The train was passing over a trestle 20 ft. high. Bronson, in falling, fractured his limb. He sued for $10,000 damages, alleging neglect on the part of the company in not keeping the doors secure. The jury found for the defendant. Judge Caldwell reversed the decision. He said the company was not compelled to maintain vestibules, but when they have them it is their duty to keep them secured.

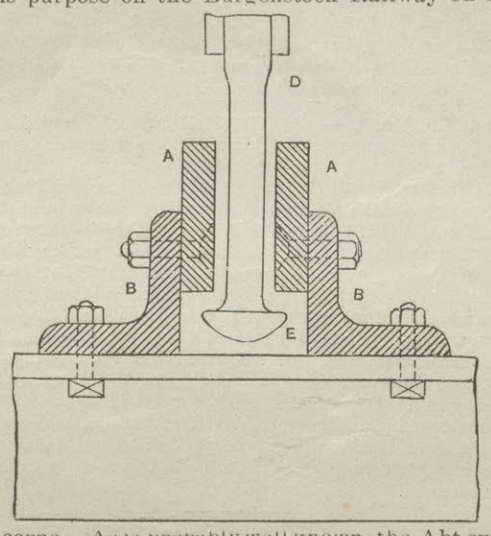
Air Brakes Worked in Court.—The courtroom of the supreme court of the United States, which is seldom profaned by any unseemly thing, one day last week resembled a railroad shop. A case was being heard in which the Westinghouse and Boyden air brakes were involved, and in order to better explain their controversy the attorneys for the contending companies had caused air brakes to be set up and operated in the courtroom. An exhibition of this kind is a rare thing in the supreme court. When, a year ago, an attorney arguing before the court, was allowed to use a large chart in explaining his arguments, it was thought that a great concession had been granted. Now that the court has permitted an exhibition of air brakes to go in the sacred chamber, almost anything in the line of practical illustration may be expected. This case, which was taken from the United States circuit court of appeals for the fourth circuit to the supreme court of the United States upon a writ of certiorare, was argued by Mr. Hardy of Pittsburgh, and Mr. Betts for the Westinghouse Company, and Mr. Hill of Chicago, and Mr. Fenton of Philadelphia for the Boyden Brake Company. The drawings and models shown were numerous and very interesting, including a complete freight brake operated by compressed air as in actual service. Eight of the justices sat, Justice Brewer being absent. A decision is expected in a few weeks.

Raising a Drawbridge by Wedges.—A novel piece of engineering was done in Chicago on October 25, which was watched with much interest by civil and railroad engineers. The bridge over Clark street was raised for the purpose of inserting new casters in the place of the old ones, which were so much worn down as to be at least two inches too small. Assistant City Engineer Roemheld, who had the work in charge, used a series of wedges in place of raising the structure by means of jack screws. The experiment proved an entire success. There were eighty of the old casters to be removed. The old system would have required that the bridge be lifted on jackscrews, so that all the casters could be taken out at the same time and the new ones put in their places. By the new method the work was greatly simplified and shortened. The casters were so close together that it was impossible to place wedges between them which would be long enough to reach the required hight at their thicker ends, unless the angle of the incline should be too great for the power of the bridge engine. To overcome this difficulty, applying the principle of the inclined plane, Mr. Roemheld made his wedges in sections. Those used yesterday were in four parts, each about eighteen inches in length. The thinner sections of wedges were placed first in front of six of the old casters, separated at such intervals as to distribute the weight of the structure in the right proportion. Then the bridge was made to revolve, the six casters rose on the wedges and lifted the bridge free from the remainder of the old casters. When these had been taken away there was room for laying the remaining sections of the wedges one after another, until the elevation of the bridge was sufficient to allow the placing of the new casters. When all the new casters had been placed for which there was room the next move was to lower the

bridge so that its weight would rest on the new rollers, relieving the six old ones that had done extra service, so that they might be removed. A crew of twenty men, under the supervision of Mr. Roemheld, worked through the daylight hours in changing the casters. Under the old system of work it is estimated that the change could not have been effected in less than three days, and it would have required the erection of timber false work to accomplish it. In the work as done not a stick of timber was used.

AN IMPROVEMENT IN RACK RAILWAYS

In view of the possibility of serious accidents resulting from derailment of locomotives and cars on rack railways, an example of which was seen in the accident which occurred some time ago on the Snowdon Mountain Railway, engineers have been looking for improvements which may be made to the equipment of such lines which will prevent the cogs from leaving the rods and the cars from leaving the track. The accompanying illustration taken from the "Practical Engineer" shows the means adopted for this purpose on the Burgenstock Railway on Lake



Lucerne. As is probably well known, the Abt system of mountain railways employs a rack consisting of two bars which are bolted to angle irons secured to the ties and which are so arranged that the teeth of one rack are opposite the spaces in the other, so that at least two teeth on the racks are always in mesh with the pinions of the locomotives. The following description is given:

"In the sketch A A are the rack bars bolted to the angles B B. The racks are bolted independently to the angle, so as to allow a clear space between them. Attached to each carriage or locomotive are two bars D, having swelled heads E, which prevent the pinions from ever rising clear of the racks. Sufficient clearance is allowed to permit of a reasonable amount of play in the springs.

As will be seen, the arrangement is simplicity itself, and would add very little to the cost. It is therefore, the more to be regretted that some such safeguard was not adopted on the Snowdon Railway in the first instance, as such accidents as that which occurred on this railway, even if unattended with loss of life, have a very serious effect in diminishing the confidence of the general public."

RATES OF COMBUSTION AND EFFICIENCY OF LOCOMOTIVE BOILERS.

A paper entitled "The Effect of High Rates of Combustion upon the Efficiency of Locomotive Boilers," by Prof. Goss of Purdue University, was presented at the September meeting of the New York Railroad Club and was published nearly in full in the RAILWAY REVIEW of September 19 of the current volume. This paper called forth an interesting discussion of which the following paragraphs give a summary:

Mr. Forney—Professor Goss, in carrying on his experiments, in one case burned 61 lbs. of coal per square foot of grate area per hour, in another 84, in a third 124, and in the fourth 241. Now, the evaporation in pounds of water per pound of coal varied in these tests, respectively, 8.26, 7.87, 7.52, 6.67, showing that the evaporation diminished as the rate of combustion increased. This is all very clear and plain. There is one point, however, that it would not be out of the way to mention here: An ordinary passenger engine would burn about 50 lbs. of coal per mile on a grate of, say, 25 sq. ft. of surface. The rate of combustion is almost 61 lbs.; that is the average rate over the whole run of, say 100 miles while the maximum is very much higher and the minimum very much lower; and the question is whether the economy would increase with a lower rate of combustion. During a large part of the work it is burning less than 61 lbs. per square foot of grate area, and very probably, if it goes down to a very low point, the economy would be less. If you have a Wootten boiler with a very large grate, it might be very much lower than 10 lbs. per square foot. So that I think, in that respect, Professor Goss' experiments are not quite conclusive.

From the investigations he has made, it seems to me probable that what would result in the greatest economy would be a larger fire-box and a larger grate area than we have at present. Now, as you know, some recent locomotives built in this country have all their driving axles in front of the fire-box. With engines of that kind it is possible to widen out the fire-box as wide as you want. Mr. Rhodes, of the Chicago, Burlington & Quincy Railroad, has experimented for the last few years with an engine of that class, and he told me he was getting 15 per cent economy out of it, compared with others running alongside of it. Now, if that is accomplished by simply getting a wider and deeper fire-box, 15 per cent economy achieved, it is certainly important for the railroads to know it. Some years ago Frederick Siemens read a paper calling attention to the fact that as soon as the flame came in contact with any solid substance combustion was immediately arrested. You can prove this by putting a wire or a rod into an ordinary gas flame—it will immediately begin to smoke—and his conclusion was that in all furnaces the aim should be to keep the flame away from the sides and top of the fire-box until the process of combustion was entirely completed. By having that fire-box which Mr. Rhodes has, which is very nearly a cube, it is very much easier to keep the flame away from the sides and top of the fire-box. It therefore seems desirable that we should have a fire-box not only of that form, but with the sides of the grate covered with dead plates, and in that way keep the flame away from the sides before it enters the flues; and I believe it is due to that as much as anything else, that Mr. Rhodes has achieved the economy referred to. Of course, a large grate has a great deal to do with it; but the protection which the flame has in a large fire-box is an important element.

In reading on this subject some time ago, I found an article published in a German paper, in which it called attention to the fact that by injecting a small stream of water into the fire-box it would make a more intense combustion than could be obtained without it. The writer had experimented with that method and proved that he could promote combustion in that way. It seems odd to say that by squirting water into a flame you can make it burn more freely. Some time ago in talking with Dr. Dudley, of Altoona, who is an authority on such matters, he said that it was found by some Frenchman that when carbon was entirely free from moisture that it did not readily combine with oxygen. Under those conditions it was, in fact, almost impossible to have them combine, and a certain amount of moisture seemed to be necessary to promote combustion. That is a sort of collateral proof of the correctness of my German friend's experiments.

Another curious fact, and which Professor Goss refers to, is that at very high temperatures a very large amount of carbon monoxide C O is formed, and it does not then readily combine to form carbon dioxide $C O^2$. In the latter combination very much more heat is developed than when carbon monoxide is formed. This waste approximately occurs at the higher temperatures, and it seems probable that the jet of water has the effect of supplying moisture and cooling down the fire, and thus promoting the combustion of the fuel.

There seems to be a sufficient promise of success in the direction indicated to warrant some of our railroad companies to have thorough series of tests made. The ground which should be covered would be to test, first, large fire-boxes, nearly cubical; next, try the water jet and see what there is in that; third, grates and dead plates of different proportions.

Mr. Geo. S. Strong—I am very glad to see such experiments made by a man of Professor Goss' standing, and I think that this kind of investigation will do more to convince railroad people of the necessity of having boilers of sufficient capacity to do their work than any other class of investigation. I have noticed on the test made by Prof. Denton and Mr. Deane, on the Old Colony road, between Boston and Providence, where they ran from about 84 lbs. down to 54, they got a saving of something like 20 per cent, due to the reduced rate of combustion when they got down to 54. On the Lehigh Valley we made a number of tests with engines having 60 sq. ft. against engines having 35 sq. ft., and in that case we got about 33 per cent saving, due to increased grate area and better combustion. I have no doubt that it will be found that when we get below 50 lbs., even as low as 30 lbs., in locomotive practice, we will get good results. The simple fact is that a very large part of the coal is carried through the smoke stack in the form of coke which is not consumed, but carried through and out into the air, and this is evidence that a very large amount of fuel is wasted. The question is: How is it possible to get down as low as 30 lbs?

Mr. Rufus Hill (Pennsylvania Railroad)—I would like to call Mr. Forney's attention to a series of experiments made some years ago, in which he was interested in a scientific, and I in a practical way. At that time the Wootten boiler was impressed upon me very strongly for the burning of pea coal. We equipped an engine which was 17 x 24 in., with a Wootten boiler, and the hard coal feature of it did not suit our service. At that time we were burning semi-bituminous coal, so I came to the conclusion that we would make a soft coal engine of it, and Mr. Forney found it out, and came over and offered some suggestions, and we did make a series of experiments in line with this paper and it agreed with what the professor has proved in his experiments. We wanted to ascertain the maximum and minimum grate surface necessary. The engine was used on passenger excursion trains, having a maximum of 24 to 25 passenger coaches loaded with people, making 30 miles an hour. The grate area of 64 sq. ft. would not do very well, as we had too much grate surface. So I commenced to reduce it by bricking off 3 x 8, 24 ft. of grate surface. With the reduced grate surface we made the engine an eminently successful soft coal burner. Then I went to work and built a brick wall right in the middle of the furnace, making practically two furnaces, and we not only got an economical soft coal burner but we burned up the smoke as well. We fired alternately on one side and then on the other. The combustion chamber was a good feature, and gave us a chance to burn all the smoke and gas, and we did not pass any sparks through the smoke stack. Mr. Forney was interested in that experiment at that time in a scientific way, as I said, and I in a practical way, and we found we could get too much grate surface as well as not enough.

Mr. Sague (Schenectady Locomotive Works)—Any locomotive man must realize the great value of tests of this kind, as all locomotive designers must frequently feel the lack of experimental data upon which to base their designs. If the problem is brought before us as to how much of an engine we can supply for a certain specified weight on the track, the question at once arises: How much of that weight should be put into the tube heating surface, and how much into the size of fire-box? and data on the subject is lacking, and the results of experiments vary greatly.

Referring to the diagram, Fig. 2, Professor Goss says that the area a, b, c, represents the loss occasioned by deficient heating surface. As I take it, the curve a, b, is the result given by previous tests of this engine, in which the grate surface was maintained constant, and in which the rate of combustion and total amount of coal burned were increased by increasing the draft. The loss shown by these test is very much greater than when the total amounts of coal burned on the grate were constant, as in the tests detailed in the paper. The area a, b, c, which represents the loss due to deficient heating surface, can be compared with the area a, c, e, which represents the losses due to increased rates of combustion; and we can therefore, I think, form the conclusion that the loss due to deficient heating surface is greater than that due to deficient grate surface in the ratio of the area a, b, c to a, c, e.

It will also be noted that an important part of the loss found in these tests is due to the amount of sparks which were drawn through the tubes. In the test burning 61 lbs. of coal per square foot of grate, this loss was 4.3 per cent; and at 124 lbs. about 10 per cent. Professor Goss speaks of the coal being friable, and consequently the engine probably emitted a great many more sparks than it would have done with some other grades of coal.

I would also say that the rate of combustion in test No. 4, 241 lbs. is much greater than anything that is used in locomotive practice, except in a very few special cases of hard service with engines having the deep fire-box between the axles and frames; and if we want to get at the loss which occurs in average locomotive service, we would refer to test No. 3, which shows about 124 lbs. of coal per square foot of grate per hour. Using this figure for some large passenger engines which we have recently built, having about 30 sq. ft. of grate area, would give 3,700 lbs. of coal burned per hour, or nearly two tons—a large amount to burn in any locomotive. Mr. Forney has mentioned that locomotives, as ordinarily run, do not show very high rates of combustion; and though they may be reached under certain conditions of service, they do not represent average practice. If the rate of combustion is calculated from the number of miles run per ton of coal, the average figure will be comparatively low; and I therefore think that, instead of assuming that the loss which takes place in locomotives is that which would be indicated by test No. 4, it would be fair to say that the loss is nearer that shown by Test No. 3.

Mr. W. H. Marshall—I think that the one point on which Professor Goss has been striving to throw light has not been brought out in this discussion as fully as it might have been. We have a good many tests in service which show conclusively that the evaporative efficiency of boilers falls off as they are forced, but I think this test stands alone in its attempt to show to what that loss of efficiency is due. If we know that a boiler is forced in a certain service, and that the performance has fallen off, that does not by itself indicate to us what we should do—make a change in the grate, or furnish a larger heating surface, or both. In looking over the figures as presented here, the point that astonished me most is the loss by sparks. I did not suppose it was as great; and as Professor Goss says that his coal is particularly friable, it may be that the loss is not so great in the ordinary service; but that is something that we do not know until more tests are made. I think this series of tests is of value, not only in itself, but because it suggests lines on which other tests should be made.

In the last row of figures in the lower table you will find the value of the spark loss rises from 4.3 to 7.2 per cent to 10.2 per cent to 15.5 per cent in the several successive tests. Now, if we take the first test as the standard of performance we find what the excess losses are as the combustion is increased; we get it by subtracting 4.3 from the others, which gives us for test No. 2, 2.9 per cent, for No. 3, 5.9 per cent, and for No. 4, 11.2 per cent—which are the extra losses from sparks accompanying the increased rate of combustion.

The lower line in the upper table gives the total loss of evaporation in terms of the evaporation for test No. 1; and if in test No. 4, for instance, we subtract from the 19.2 loss of evaporation the 11.2 loss from sparks, we have left only 5 per cent due to imperfect combustion, imperfect absorption of the heat by the heating surface, and the additional amount of heat carried through the smoke stack.

The figures in the analysis of the smoke-box gases show that the amount of free oxygen is very large, and that would seem to point to the fact that a very large amount of air has been used—more than we would consider necessary to burn the coal in regular service; and that is particularly true of the last test, where 240 lbs. per square foot were burned, where we have 1.8 per cent carbon di oxide and 18.7 per cent of free oxygen. Throughout all the tests there are more or less hydro-carbons in the gases, showing that they have been driven off without being consumed; but it is only in the last test that we have any carbon monoxide. That analysis would indicate that there was a greater loss than 8 per cent due to imperfect combustion. It appears to me that, possibly, the presence of carbon monoxide in the last test might be partly attributable to the position of the grate for that test. If you turn to Figs. 4 to 6 you will see that as the grate was blocked the first time, the average distance from the fire to tubes was greater than in the full grate; in the second case it was the same; in the third case the grate is on the average nearer the tubes than in any of the other tests. Now, with the large amount of air passing through the fuel, the speed of the gases would be very great in passing to the tubes; and even though the passage through the tubes would be as slow as in the other tests, the action in the fire-box would be more rapid and there would be very much less time for a perfect combustion. I think that if that opening had been placed in the third quarter instead of the second from the tubes, it might have improved the result.

The whole paper is very suggestive as to what might be done, and I do not think we need confine ourselves to laboratory work in order to acomplish it all, although laboratory work is desirable and Prof. Goss' test No. 1, the weight of dry coal burned per hour per square foot of grate service was 25.47, and the water evaporated per pound of coal was 4.115. In test No. 2, the weight of dry coal burned per square foot of grate surface was 22.65, and the water evaporated per pound of coal was 7.021. In test No. 3, the weight of dry coal burned per hour per square foot of grate surface was 25.5 and the water evaporated per pound of coal was 6.64. These figures, taken from a test made in actual service, I think go to confirm the results of Prof. Goss' experiments, as explained in the paper of to-night.

INTERESTING LOCOMOTIVES FROM THE BALDWIN LOCOMOTIVE WORKS.

Among the locomotives recently constructed at the Baldwin Locomotive Works are four which are illustrated in the accompanying engravings and of which the tables give the general dimensions. Fig. 1 shows a double ended locomotive having three pairs of coupled wheels and a four wheel rear truck. It was built for the Spanish military engineers, and is for use in Cuba. The cab of this locomotive was armor clad with ⅜ in. steel plates on the sides and front and was lined with ash. The doors and windows were provided with ⅜ in. steel shutters to slide over the glass pane when required, the shutters being provided with loop holes in the center to allow of firing in case of attack. The principal dimensions are as follows:

Gage	4 ft. 8½ in
Cylinders	12 in. diam. 18 in. stroke
Driving wheels, diameter	38 in. journals, 5 x 7½ in
Total wheel base,	19 ft. 5 in
Driving wheel base	8 ft. 1 in
Weight on drivers	45,560 lbs
Weight total	71,960 lbs
Boiler diameter	36 in
Tubes,	94, 1¾ in. diam., 11 ft. long
Fire-box	38 15-16 in. long. 33⅞ in. wide, 46½ in. deep
Truck wheels	24 in. diam., journals 3¾x7 in
Tank	1600 gal. cap. located over rear truck
Heating surface fire-box	48.11 sq. ft
Heating surface, tubes	470.06 sq. ft
Heating surface, total	518.17 sq. ft
Heating surface, grate surface	9.13 sq. ft

The boiler is of the radial stay wagon top type. The steam ports are 12 in. long by 1 in. wide; the exhaust ports 2 in. wide and the valve travel 4½ in. The wheel centers are cast iron.

Fig. 2 is from a photograph of a locomotive of the "Atlantic" type built for the Lehigh Valley Railroad. It has a straight radial stayed boiler. The steam ports are 19 in. long by 1¾ in. wide and the exhaust ports are 3¼ in. wide. The valve travel is 5¾ in. The driving wheel centers are of cast steel. Other important dimensions are as follows:

Gage	4 ft. 8½ in
Cylinders	19 in. diam., 26 in. stroke
Driving wheels	76 in. diam. journals 8½x11 in
Total wheel base	24 ft
Rigid wheel base	13 ft
Driving wheel base	6 ft. 7 in
Weight on drivers	81,800 lbs
Weight on trailing wheels	30.050 lbs
Weight total	140 950 lbs
Tubes	265, 2 in. diam., 15 ft. 1 in. long
Fire-box,	114⅝ in. long, 80⅜ in. wide, 46¼ in. deep
Truck wheels	36 in. diam., journals 5½x9 in
Trailing wheels	55 in. diam., journals 7x12 in.
Heating surface, fire-box	148 98 sq. ft
Heating surface, tubes	2081.24 sq. ft
Heating surface, total	2230 22 sq. ft
Heating surface, grate surface	63.97 sq. ft

The engraving shown in Fig. 3 was made from a photograph of an engine for 2 ft. gage built for the F. C. de Cazadero a Tepetong, Mexico. Its boiler is straight, with radial staying. The steam ports are 9 in. long by 1 in. wide, and the exhaust ports are 1¾ in. wide. The driving wheel centers are of cast iron, and it will be noticed that the driving wheels are placed inside the frames owing to the limited space allowed by the extremely narrow gage. The The main and side rods bear on pins in cranks placed outside of the frames. The dimensions are:

Gage	2 ft
Cylinders	11 in. diam. by 16 in. stroke
Driving wheels	33 in. diam., journals, 5x6 in
Total wheel base	19 ft. 10 in
Driving wheel base	7 ft. 6 in
Weight on drivers	31.910 lbs
Total weight	43,410 lbs
Boiler, diameter	34 in
Tubes	62 in number, 2 in. diam., 10 ft. 11 in. long
Fire-box	37 3-16 in. long, 30⅝ in. wide, 40½ in. deep
Two-wheel truck, front and back; wheels, 22 in. diam.; journals, 3½x6 in	
Tank capacity, on sides of boiler	550 gals
Heating surface, fire-box	39.08 sq. ft
" " tubes	351.67 sq. ft
" " total	391.65 sq. ft
" " grate surface	7.9 sq. ft

A mogul compound locomotive for the Norwegian State Railways is shown in Fig. 4. This boiler is of the straight radial stay type, and the fire-box is carried between the two rear axles. The valves are of the piston type and balanced. They have ports 16¾ in. long by 1¼ in. wide. and the exhaust ports are 3¾ in. wide. The travel of the valve is 4¾ in. The driving wheels are cast iron. This locomotive enjoys the distinction of being the 15,000th built by the Baldwin Locomotive Works.

Gage of road	3 ft. 6 in
Cylinders, high pressure	9 in. diam. by 18 in. stroke
Cylinders, low pressure	15 in. diam. by 18 in. stroke
Driving wheels,	46½ in. diam.; journals, 5½ by 7 in
Total wheel base	18 ft. 7 in
Driving wheel base	12 ft
Weight, total	51,844 lbs
Weight on drivers	42,244 lbs
Boiler diameter	44 in
Tubes	157 in number; 1½ in. diam.; 8 ft. 1 in. long
Fire-box	52 7-16 in. long, 30¼ in. wide, 49⅛ in. deep
Truck wheels	26 in. diam.; journals, 4x6 in
Tender tank capacity	1,400 gals
Tender wheels	26 in. diam.; journals, 3½x6 in
Heating surface, fire-box	61.59 sq. ft
" " tubes	493.18 sq. ft
" " total	554.77 sq. ft
" " grate surface	11.00 sq. ft

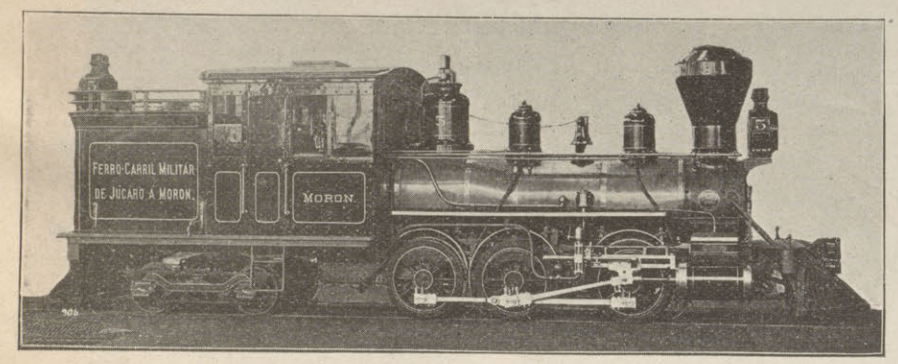


Fig. 1.—SPANISH MILITARY ENGINEERS' LOCOMOTIVE.

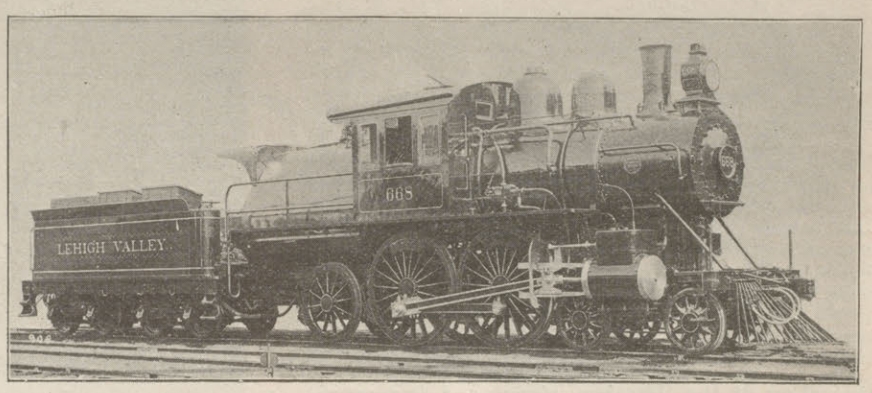


Fig. 2.—PASSENGER LOCOMOTIVE—LEHIGH VALLEY RAILROAD.

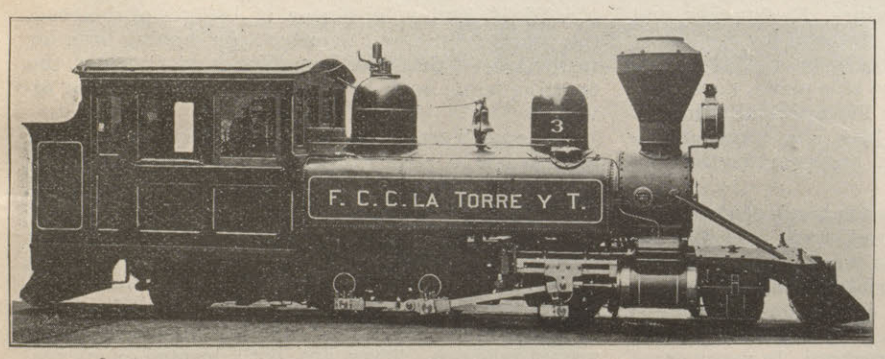


Fig. 3.—MEXICAN NARROW GAGE LOCOMOTIVE.

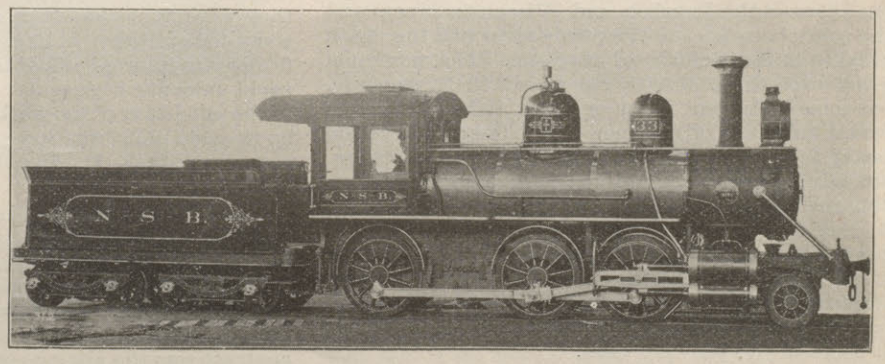


Fig. 4.—MOGUL COMPOUND LOCOMOTIVE—NORWEGIAN STATE RAILWAYS.

INTERESTING LOCOMOTIVES FROM THE BALDWIN LOCOMOTIVE WORKS.

paper is excellent; but in England some tests were recently made of a locomotive boiler jacked up in the shop and one on the road. Unfortunately, it was a switching engine and not very large, and the rate of combustion was small, and, furthermore, the coal used was very good, so that it would not apply to American practice; but I would say that the laboratory and road tests agreed closely in the rate of combustion per square foot of grate surface per hour, the evaporation under those two conditions was almost the same, and an analysis of the smoke-box gases showed them to vary very little; and the whole comparison shows that a test can be made on the road and check off very closely with one made in the laboratory—but, of course, a great deal can be done in the laboratory that can not be done on the road.

Mr. Higgins (Lehigh Valley Railway).—The paper presented by Prof. Goss is of value in a general way, in that it shows the saving that may be effected by having the grate surfaces of locomotive boilers made sufficiently large to reduce the consumption of fuel per square foot of grate per hour to an economical point; but at the same time, I think there is such a thing as having too large a grate surface and I think steps should be taken to ascertain the maximum limit of grate surface with anthracite and bituminous coal, in connection with the cylinder volume and the class of work that the locomotive is designed for.

I wish to confirm the figures presented by Prof. Goss as to the efficiency of the boiler being decreased when the amount of coal consumed per square foot of grate surface per hour is increased, by results of a test made on the Lehigh Valley road, last fall, with an engine having cylinders 20 x 24 inches, grate surface 80 x 114 inches; four pairs of drivers, diameter 50 inches—fuel composed of one-third bituminous and two-thirds buckwheat. The tests were made with the engine in actual freight service. During

Engineers' Club of St. Louis.

A regular meeting of the Engineers' Club of St. Louis was held October 21. Mr. William H. Bryan then read a paper on "Boiler Efficiency, Capacity and Smokelessness with Low Grade Fuel." The discussion now going on among the mechanical engineers of this country regarding the best method of expressing the economic performance of boilers was explained, and the revision of the generally accepted code for making boiler trials shown to be necessary. The author strongly advocated the statement of

oiler efficiency in the percentage realized of the calorific value of fuel, taking care that the coal used is carefully sampled, and its calorific power determined by the most accurate means possible. The author presented a table giving the results of a large number of trials which he had made to determine the efficiency and smokelessness of various types of boilers, with and without improved settings. The table gave the maximum, minimum and average results secured. The paper was accompanied also by a table of fuel analyses and calorific determinations covering all the common Southern Illinois coals coming to this market.

The discussion which followed was participated in by Messrs. Russell, Kinealy, Flad, Moore, Wheeler, Leighton, Ashburner, Harrington and Wm. T. Bonner of Cincinnati.

DOUBLE TRACKING ON THE CHICAGO & NORTHWESTERN RY.

The traffic of the Chicago & Northwestern Railway which originates in Minnesota and Dakota and that delivered to it from the Chicago, St. Paul, Minneapolis & Omaha Railway is united at Elroy, Wis., on its way to Chicago and Milwaukee. The business is carried over a single track from Elroy, 213 miles from Chicago, to Madison, and over this section of 73 miles the traffic is specially heavy. From Elroy to Baraboo, 36 miles, the line runs through the valley of the Baraboo river, and is approximately a water grade. Between Baraboo and Madison, 37 miles, the road crosses two heavy divides, one between the Baraboo and Wisconsin rivers and the other between the Wisconsin river and the chain of lakes in the vicinity of Madison. The maximum grade over these divides was about 69 ft. per mile, but some hills four miles or more in length have a maximum grade of one per cent. Over this section heavy ten wheel engines with 19x24 in. cylinders, are rated for 650 tons and between Elroy and Baraboo, the same engines are rated for 1650 tons, a difference of 1,000 tons. The fact of the low rating between Baraboo and Madison and the large amount of traffic handled, explains the necessity for double tracking this part of the line. Serious delays have occurred there and steadily increasing business made it necessary to provide relief.

In addition to the construction of another track, the work possesses special interest from the fact that in a large number of cases the grades have been improved, and in places the alignment has been straightened. The rectification of grades covers about 60 per cent of the distance, including the taking down of short summits from 6 to 10 ft. and the raising of intervening sags corresponding amounts. In specific cases grades have been reduced which will materially increase the rating of locomotives, notably in the neighborhood of "The Devil's Nose" the summit about five miles south of Baraboo. In 3½ miles a total reduction of 23 ft. has been made at the summit, the maximum grade on this hill now being 53 ft. per mile instead of from 53 ft. to 69 ft. as formerly. Within the limits of one mile, 87 deg. of curvature have been eliminated by taking out two sets of heavy reverse curves and constructing two fills of 75 and 55 ft. in hight respectively, and ranging in length from 1500 to 1800 ft. These fills were made from temporary trestles constructed for the purpose. The material used for this work was obtained from the cut near Kirkland and amounted to more than 400,000 cubic yards. It was excavated with two 50-ton Bucyrus steam shovels, one of which has worked continuously for six months and the other for three months, part of the time both being worked day and night. The alignment both of the old and the new arrangement, together with the profile of this work, are shown in Figs. 1 and 2, and the heavy work in the cut near Kirkland may be appreciated by referring to Fig. 3 which shows one of the steam shovels at work. The total depth of this cut is 83 ft. and it was made with three benches or four separate cuts. The appearance of the work near the summit showing the difference in the new and the old grade may be seen in Fig. 4, which was taken from a point immediately north of "The Devil's Nose". The difference between the new and the old formation level is not the maximum at this point but this view indicates the manner of obtaining an advantage of 120 tons increase in the rating of the locomotives when the work is completed.

Messrs. Winston Brothers, of Minneapolis, are the contractors for the whole of the grading, and they were furnished four engines, 80 flat cars, and about four miles of sidings. Material for the heavy filling was plowed off of the cars by a Lidgerwood rapid unloader with center and side plows, according to the condition of the work. The material unloaded by the side plow was spread by a side spreader, designed by Mr. E. H. Beckler, engineer for the contractors.

The standard distance between track centers is 13 ft. The grading of the second track and the improvment of the existing main track involved over a million cubic yards of material, the most of which was earth work. This was let in one contract to Messrs. Winston Bros. and a notable feature of the contract was the absence of overhaul. In many cases the extreme haul was as high as 6,000 ft., and in one special case, even 8,000 ft. The rock excavation was begun in January of this year, the earth work being started in April. The entire improvement is completed except the work at "The Devil's Nose," which involved considerable rock excavation. The road bed in the cuts that were taken out is 37 ft. in width, 1 ft. below the bottom of the ties, the slopes being 1½ to 1. The width of the new embankments is 33 ft. over the formation level and with the same slopes as the cuts, shrinkage being added in hight and width to all the embankments.

Ninety-four bridges and culverts were extended for the second track or constructed for double track, while trestles to the length of 1664 ft. were replaced by 12 permanent bridges. Thirteen existing arches were extended and also 20 existing piers and abutments, which indicates the large amount of masonry work. It should be stated that one stone arch was built new. The masonry construction was started in January and with two exceptions, the work was completed in July. There is one 6 ft. arch, one of 10 ft., four of 15 ft., two twin arches of 15 ft., four of 24 ft., one twin arch of 24 ft., and a single arch of 32 ft. diameter. Sixty per cent of the stone used was a very durable red sandstone quarried about ten miles north of Baraboo. The remainder was a hard blue limestone from the company's quarries at Duck Creek on Green Bay, Wis. There were no special features in the masonry work, except a case of one deep foundation in a marsh about six miles north of Madison. At this point a 55 ft. deck plate girder bridge rests on stone abutments which are supported on piles driven 70 ft. from the level of the water and although the marsh is very soft, no settlement has so far occurred. Near "The Devil's Nose," where the reduction of grade is about 10 ft., it was necessary to lower a 24-ft. stone arch about 4 ft. This work is located at the south end of the portion included in the drawing in Fig. 1. The iron work, consisted of deck plate girders of from 30 to 75 ft. in length. There is one bridge for double track of through plate girders 75 ft. long with floor beams and stringers, and there are two with 21 ft. through girders with channel floors. The iron work was constructed according to designs of Mr. W. H. Finley, engineer of bridges of the road, the contract for their construction having been let to the Lassig Bridge & Iron Works of Chicago, the erecting being done by the bridge crew of the division.

The second track has been laid with the C. & N. W. standard 80 lb. steel rail with 5 in. flange and a hight of 5 in., which is furnished with the Truss Rail Joint throughout, having a 26 in. base plate and 13 in. angle bars. In all cross-overs and switches the company's standard spring rail frog No. 10, designed by Mr. E. C. Carter, has been used with the exception of two No. 14 leads at the ends of the Wisconsin river bridge. These leads are put in so that there are no reverses. They are both located on curves. The switches are all trailing points and the sidings are connected at one end only. The track is ballasted with 12 inches of material between the formation level and the bottom of the ties. An 8 in. lift was first made above the formation level with a coarse gravel from Wales, Wis. The final lift of 4 in. and the dressing of the track having been done with a finer gravel from Beloit. The average haul of both these classes of ballast was 70 miles. The track was dressed with ballast at the top of the tie midway between the rails, sloping to a shoulder 3 ft. from the head of the rail, at which point the gravel was 3 in. below the level of the top of the tie.

Aside from the minor changes of small waterways, there were two cases in which the diversion of streams made possible a saving of about $10.000 in bridge

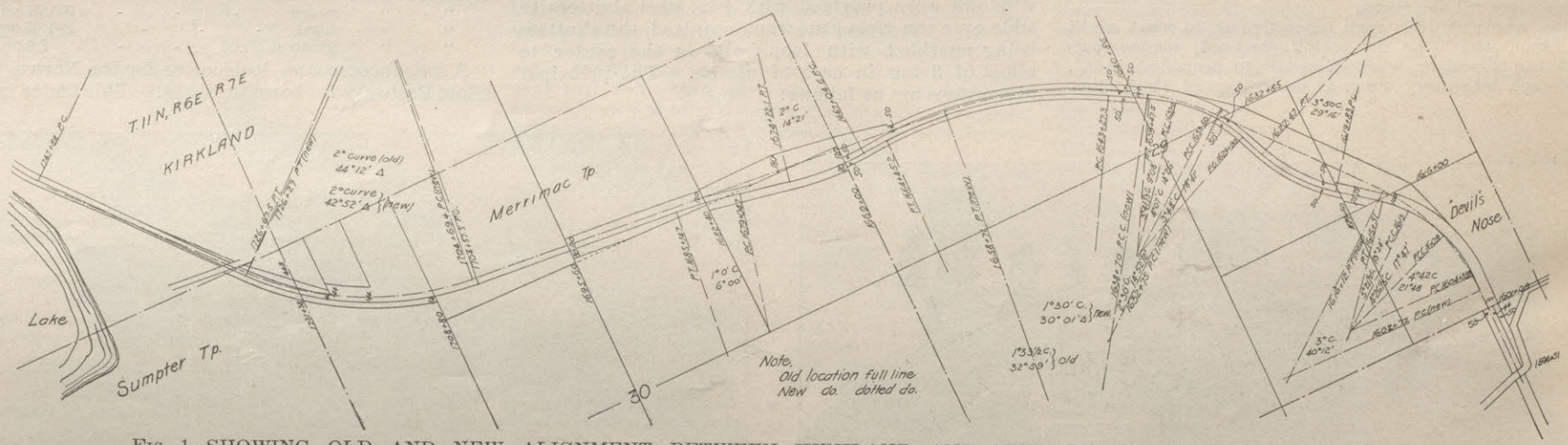


FIG. 1—SHOWING OLD AND NEW ALIGNMENT BETWEEN KIRKLAND AND "THE DEVIL'S NOSE."—C. & N. W. RY.

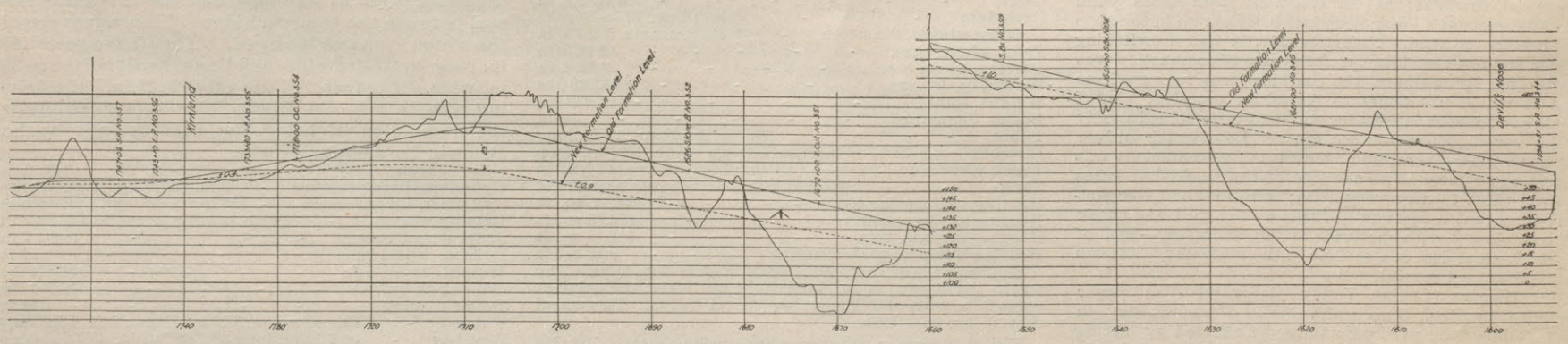


FIG. 2.—SHOWING IMPROVEMENT IN GRADE BETWEEN KIRKLAND AND "THE DEVIL'S NOSE"—C. & N. W. RY.

work. In addition to this about 1,600 cubic yards of masonry and two pairs of 75 ft. plate girders were saved beside getting rid of four waterways. Altogether this stream diversion saved 62,000 cubic yards of earthwork, and as the material removed was needed for filling, the diversion may be said to have been made without cost. The manual block system is in use employing semaphores with the standard C. & N. W. spectacles, showing red and green, the average length of block being 3½ miles. The iron bridge over the Wisconsin river at Merrimac will be operated as a single track with switches to the double track at each end. The National Switch & Signal Co. has contracted to furnish a 12 lever interlocking machine operating three switches, three derails and four signals at the north end of the bridge, and an 8 lever machine at the south end to operate one switch, two derails and three signals. These two machines will be electrically interlocked so that the operators will have to assist each other in passing trains over the bridge and conflicting signals cannot be given. The water tanks on this section of road have been improved, the company's standard 24 ft. tank erected upon 24 ft. posts being used. From each tank a 12 in. pipe connection leads to a 10 in. standpipe, the standpipes being so arranged that passenger engines may take water while the necessary station work is being done. The water works apparatus is that of the U. S. Wind Engine & Pump Company of Batavia, Ill. Where platforms are located between the tracks the top of the planking is at a level with the top of the rail and where platforms are built near stations, the top of the platform is 8½ in. above the level of the top of the rail.

These improvements are exceedingly interesting and they involve a number of engineering problems which have been skillfully worked out. The construction has been admirably conducted, in such a manner as to keep the work moving at all times without one part delaying another, and with the amount of masonry constructed this is saying a great deal. Altogether this is the largest piece of work of this character which we have heard of as being done in one season. In addition to the trackwork, a number of overhead highway bridges were constructed which were built of the material in twelve riveted lattice spans, 48 ft. in length, which were taken from the Wisconsin river bridge, and were replaced in that structure by an equal number of deck plate girders.

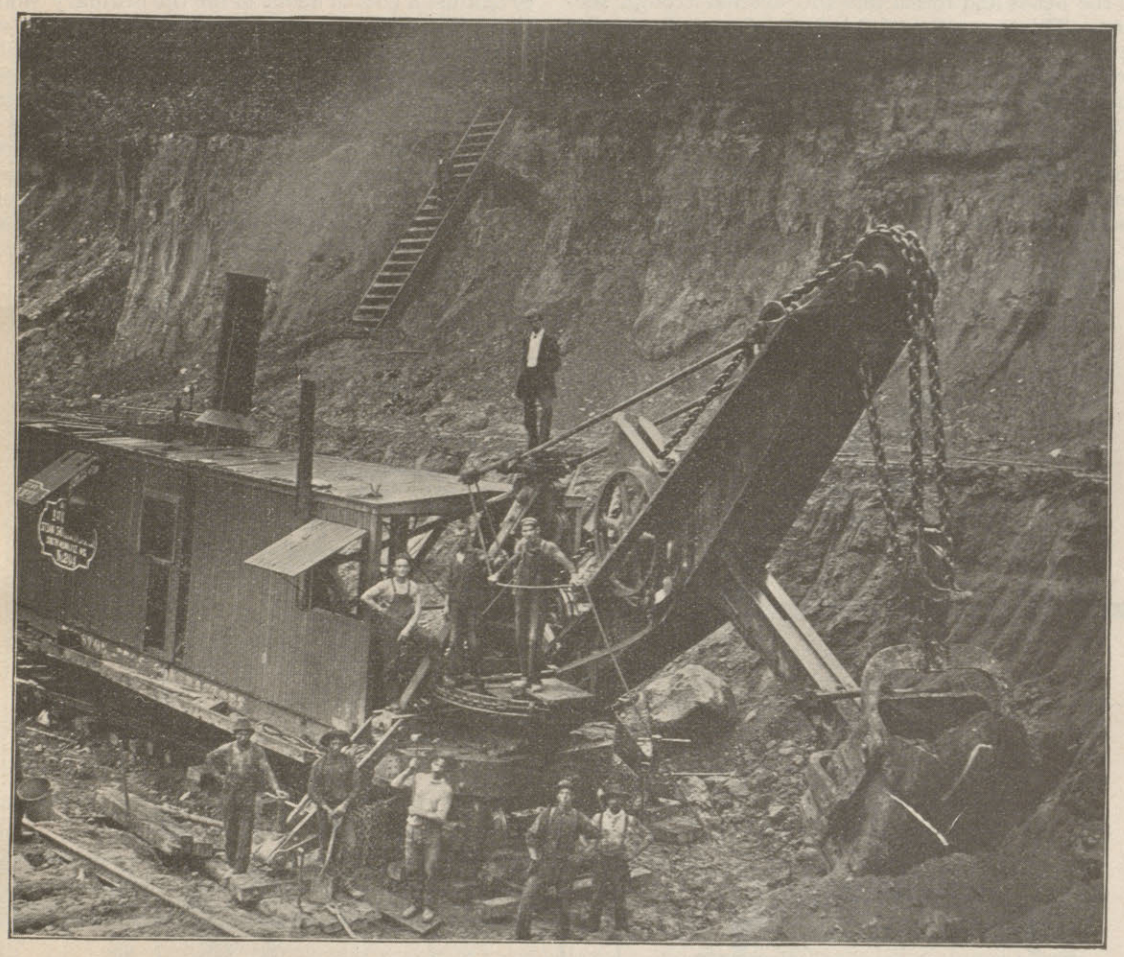


FIG. 3.—BUCYRUS SHOVEL IN DEEP CUT AT THE SUMMIT.

FIG. 4.—IMPROVEMENT NEAR SUMMIT.

The improvements were under the charge of Mr. E. C. Carter, principal assistant engineer, and the construction was carried out under the immediate supervision of Mr. H. W. Battin, engineer of second track. That such an undertaking was successfully carried through in a single season, and without interfering in the slightest with the regular traffic over the road, which at all times was heavy, speaks highly of the work of all the engineers concerned. The company had from 500 to 700 men on the work, and in addition to this the contractors worked between 500 to 600 men.

ARE SWITCH AND LOCK MOVEMENTS SAFE.

The subject of the safety provided by switch and lock movements in interlocking work was discussed at the September meeting of the Railway Signaling Club, based upon the paper presented at that meeting by Mr. W. H. Elliott, signal engineer of the C., M. & St. P. Ry., entitled, "Is the Switch and Lock Movement Safe?" This paper was published in the RAILWAY REVIEW of September 26, 1896. The discussion is given in abstract as follows:

Mr. J. I. Vernon—(New York, New Haven & Hartford Railroad Company, discussion by communication)—I do not consider a switch and lock movement as safe as a facing point lock and I do not think bolt locks attached to signal wires can be made to work properly in all cases. A spring attachment to a switch is not sufficient to make a point spring enough from the stock rail to prevent its being locked in case of a break or disconnection in the connections from the tower to the switch. My idea is that our switch connections are not as strong as they ought to be and our pins and cotters are not security enough to prevent them from becoming disconnected of themselves. What I have reference to in the strength of the connections, is the pipe joints. I think the plugs we use ought to be longer and they ought to have two rivets in each end instead of one as we now use, and also they should have longer sleeves. By this improvement in the connections I do not think there would be any possibility of breakage, except through an accident which could be easily discovered. Also, the ⅞ in. pins used at the connection of every switch ought to have nuts and washers as well as the split cotters. In fact I am now using these pins with nuts and washers on all movable point frogs and am going to use them at the connections to all switch points. I never did have a case of a switch becoming disconnected, but I understand there have been such cases and I know that I am just as liable to have them as anyone else and I am anxious to guard against it.

Mr. H. M. Sperry—Mr. Elliott deserves the thanks of the club for the careful manner in which he has taken up this subject. The switch and lock movement, when used in connection with an efficient bolt lock, is undoubtedly a safe device. As to whether it is any better than the facing point lock, is another question. In England, switch and lock movements are used on one line only, the Midland. In Germany, however, switch and lock movements are used exclusively, but as Germans use wire for operating their switches and do without detector bars, the government requiring all machines to be so arranged that a train can run through the switch without damaging the apparatus, very few of us I believe will admit that the Germans follow what we would consider the best practice. Mr. Elliott has pointed out very clearly the disadvantages of the switch and lock movement, that is, the short stroke of the plungers and the heavy working of the levers. Against this we have a saving in the first cost and possibly a little saving of time in operation. There is no saving if the levers are over weighted.

It should be remembered here, that a saving in the first cost is not always true economy, and I think all of us can point out plants that are costing about 50 per cent more for repairs than they should, on account of the saving that was made in their first cost. Facing point switches, whether they are operated with switch and lock movements or by facing point locks, should be fitted with bolt locks, in order to insure the greatest measure of safety. Stevens & Sons of England in 1884 brought out an improved bolt lock, which, in addition to detecting the position of the switch has a connection to the facing point lock plunger which detects its position, therefore making it necessary for the switch to be in its proper position and properly locked before any signal can be cleared.

There is one feature that I think we should not forget, and that is the importance of careful maintenance; no matter how perfect our switch and lock movements, facing point locks, bolt locks, duplex locks, etc., we are still dependent in a measure upon the careful inspection and maintenance of the apparatus. In this connection I would like to present a code of rules that I issued in 1886 as to the proper maintenance of facing point locks, and I would urge that in considering the subject of switch and lock movements, facing point locks, etc., that some attention be paid as to the proper method of inspecting and maintaining them:

1. The plunger should not be withdrawn more than one inch from the front rod through which it passes.

2. The full stroke (8 inches) of the plunger must be retained and upon no account reduced.

3. The end of the plunger must be kept square and must not be tapered; the sharp edges may be taken off, but no taper allowed.

4. The top of inside detector bar in its normal position, should be 1¾ in. below the top of the rail.

5. The facing point casting to be fastened to tie with ¾ in. bolts fitted with Verona nut locks.

6. Wrought iron plates to be used to hold the points of the switches to accurate gage.

7. The pipe from plunger to bell-crank should run parallel with the rail.

8. To test facing point lock; Have the switch lever pulled over, previously putting a nail or piece of iron 1-16 in. in thickness between the tongue of the switch and main rail; if the plunger of the lock can then be pushed through the hole of the front rod, the latter is incorrectly fitted and must be changed. Test the switch in the two positions. This test should be made with the plunger disconnected so that it can be pushed in with the hand. When the switch is quite home the plunger should be perfectly free in the front rod; when the switch is 1-16 in. open, the plunger should not be able to enter hole in front rod.

Mr. Cox—(Hammond & Blue Island R. R.)—Our Dolton plant is being put in by the Pennsylvania Co., and this plant will require about 140 levers. We do not have a switch and lock movement in the whole plant. In one of our plants we will have 223 levers, and no switch and lock movements. At "State Line" we have one that will take about 153 levers. We have adopted the facing point lock as we thought it was better, and we will have less expense in maintaining the plant than with a switch and lock movement. The oil pockets in the switch and lock movement get stiff in winter, and they are hard to keep clean and to maintain. I think you will find that to be the case particularly in winter when there is snow and ice, if they are not used frequently they become stiff and are much harder to move. You will not find that trouble with the facing point lock.

Mr. Wileman (L. S. & M. S. Ry.)—From my experience I would not have a switch and lock movement on a plant if I could help it. In the first place, I consider them a great deal more expensive to maintain, and then, as Mr. Cox has said, in cold weather the slides become covered wit frost. I have been making some miscellaneous tests o the pull required to move switches, and a very thoroughly maintained switch and lock movement with a fairly stiff new switch will require sometimes as high as 250 pound applied to the end of the slide bar to move it, whereas the mere lock and detector bar alone of a facing poin lock seldom requires more than 85 pounds. I do not thin switch and lock movements should require ove 150 pounds, anything beyond that is overloaded

Shortening the switch point has a great effect on the strength of pull required, and for this reason we have been obliged to discard the use of points shorter than 15 feet. On a new derail with a new switch point I have found a pull required to run up as high as 400 pounds with the joint tightened up, and by loosening the bolts, the resistance is greatly reduced. On derails we run up as high as 250 and 300 pounds when it was in the open position, but I think about 175 pounds I found the most desirable. I do not think that enough is made of the fact of the maintenance economy of a facing point lock as against a switch and lock movement. As soon as a switch and lock movement plant begins to deteriorate, it goes to wreck so rapidly and requires so much repairing that in some cases it becomes almost a nuisance, while it is almost impossible, with any sort of care, to allow a facing point lock plant to get into a similar condition.

Mr. Rhea (Pennsylvania Co.)—It seems to me that the figure of 25 per cent, given in Mr. Elliott's paper, is a little bit high on the saving that may be made by putting in a switch and lock movement, compared with a facing point lock. I agree very fully with Mr. Wileman in respect to maintenance. I think that a plant with switch and lock movements will lose the interest on the 25 per cent you have saved in maintaining it. If you look at your investment from that point of view, you are losing more than a good business interest.

Mr. Elliott—The figures on which I got the 25 per cent were taken from not very large plants, I will admit, from plants of about 36 to 40 levers. The experience of the club seems to be against the use of the switch and lock movement, but beyond the matter of repairs, I cannot see that any argument is brought to bear. As I look at it, if the switch and lock movement is safe enough to use, any expense that we can save in installation is a good thing and should be saved provided that the expense of the repairs does not amount to more than interest on the money invested. With the plants that we have in service, the majority have switch and lock movements, and I am certain that the repairs there have been but little more than what they would be if facing point locks were used. We have three or four plants where facing point locks are used almost entirely and other plants where the switch and lock movement is used altogether. The levers of one of themare certainly over-loaded. One of them has two movements from 900 ft. to 1,000 ft. from the tower, and it takes a good pull to throw this one. It has now been in service for five years and I cannot remember that we have made any repairs on it at all. One point in favor of the switch and lock movement is that while with the facing point lock it is possible for the operator to unlock the switch after the signal has been put back to danger and let the train go over the switch unlocked, this cannot be done with the combination movement.

Following this a topical discussion was held on the subject of the use of selectors, in which the opinion was expressed that they are a source of danger when used for signals on converging routes. In closing the meeting a few general remarks were made by Messrs. Rhea, Elliott and Salmon on the topic, "Where automatic block signals are used, governing through the limits of the interlocking plants, what are the proper relations between the systems?"

LONGITUDINAL SLEEPERS IN AUSTRIA.

An interesting paper was presented by Mr. W. Hohenegger, Baudirektor, K. K. Priv. Oesterr. Nordwestbahn. before the International Railway Congress on the subject of permanent way, with longitudinal sleepers, in Austria. This paper was published in the August number of the Bulletin of the Congress and the following is taken from that journal. The experiments with longitudinal sleepers were undertaken on account of the difficulty of holding the track in position on sharp curves when the speeds of trains were increased. It is stated that the curves of some sections occupy 50 per cent of the whole length of the line. The author of the paper received the suggestion for this work from the experience of the "Right Bank of the Rhine," Railway which exhibited such construction at the Vienna Exhibition of 1873. The form decided upon for the experiments employed two lateral flanges made of wrought iron. Two and one-half miles were laid in 1876, the section of the sleeper itself resembling the construction shown in Fig. 1 of the accompanying engraving. The length of the sleepers in this experiment was 31 ft. 10 in., the weight being 52 lbs. per yard. At the joints of the sleepers cross-tie supports were used which were similar in section to the longitudinal sleepers. The rail weighed 54 lbs. per yard and at intervals of 32 ft. two tie bars were passed through the webs, but these were afterward removed. The cross-ties soon gave place to lighter angle irons on account of the oscillations which were imparted to the cars by the stiff ties. The total weight of this track construction was 250 lbs. per yard and this cost was about $5 per yard more than that of the ordinary construction on wooden ties. This trough construction has been in use on a section of track along the Danube for twenty years and now requires renewal on account of wear, and relaying the system illustrated in the accompanying engraving was employed. This made use of stronger rails and sleepers. The author of the paper states that during the whole twenty years of the first experiment there has not been a fracture of a sleeper nor an actual rail fracture on either of the two experimental sections, while on the adjoining sections laid with wooden ties, the rails had to be replaced after from twelve to fifteen years service, and that the rails on the longitudinal system have already lasted twenty years without exhibiting any material damage at the joints.

The price of the structure when made of piled wrought iron was high and on account of having a large number of weldable, Scotch, iron rails on hand an experiment was made with longitudinal troughs made of the old rails which were welded together at the heads and rolled into the desired trough section. Thirteen miles of this form of support was put into service between 1877 and 1880, the cost being approximately the same with this construction as with the wooden sleepers as long as the stock of weldable iron rails lasted. In this construction, the length of a trough could be made up to 16 ft., the cost being about $5.20 per yard of permanent way. In the experiment, angle irons were used as cross-ties. The rails weighed 54 lbs. and as the experimental section is now considerably worn, it is being removed and re-laid on the cross-tie system. As to the wearing qualities of longitudinal sleepers the author of the paper says, "I must take this opportunity of drawing attention to the great advantage of iron longitudinal sleepers as compared with wooden ones, for while wooden longitudinal sleepers would have become utterly useless, by decay or mechanical destruction in the course of twenty years, the iron sleepers are still so well preserved as to be likely to last another twenty years in the station sidings where the running is slow. * * * Wooden sleepers would probably have to be renewed throughout at the end of fifteen or twenty years including most of the fastenings, whereas in the case of the iron permanent way—the first cost of which is not materially more than that of the other —nearly all the parts can be used over again."

In 1880 the weldable iron rails were used up and the third system, as herewith illustrated, was designed to be constructed of mild steel, the shape of the trough being shown in Figs. 1 to 4. The wings of the trough are beveled and are calculated to bed themselves in the ballast. The trough is 11¾ in. wide by 3 in. in hight, and weighs 60 lbs. per yard. The lateral thrust of the rail is taken by cuneiform ribs to which the thrusts are transmitted by wedge-shaped clips, by which the bolts are relieved from shearing stresses. These clips hold the rail to gage and admit of adjustment in this particular. The joint plates are shown in Figs. 1 and 2, from which it is seen that one of the plates is attached to the trough as well as to the rail, for the purpose of securing continuity of the structure. The breaking loads at the rail joint are 1,630 lbs. per square inch vertically, and 4,563 lbs. per square inch horizontally. At the sleeper joint the breaking load vertically is 2,460 lbs. per square inch, and horizontally 4,164 lbs. per square inch. At the full section of the rail and full section of the sleeper, the stresses are vertically 2,290 lbs. per square inch and horizontally 4,225 lbs. per square inch. The enormous resistance of the longitudinal sleeper in a horizontal direction deserves special notice.

The weight of this construction is 60 lbs. per yard, and the total weight of the superstructure is 284 lbs. per yard with 60 lb. rails. The cost per yard is about $6 against a cost of about $5 for the ordinary wooden ties. Forty-three and one-half miles of track were laid in this way between 1880 and 1887. The ballast employed was generally that upon which the older form of track had been used and was well drained. The cross-ties of angle iron are put in at every ten feet of rail length, and it is estimated by the author of the paper that a total life of forty years may be expected from this system. The rails last longer on the longitudinal troughs because of the less wear at the rail joints and an absence of transverse fractures, and in some cases it is estimated that the troughs will outlive a second pair of rails.

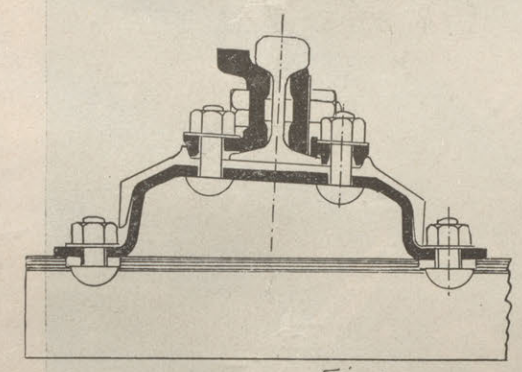


Fig. 1

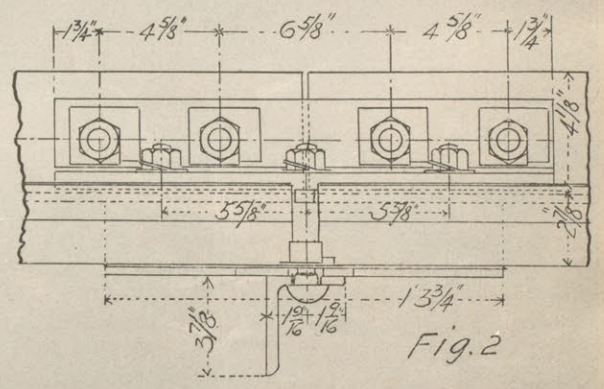


Fig. 2

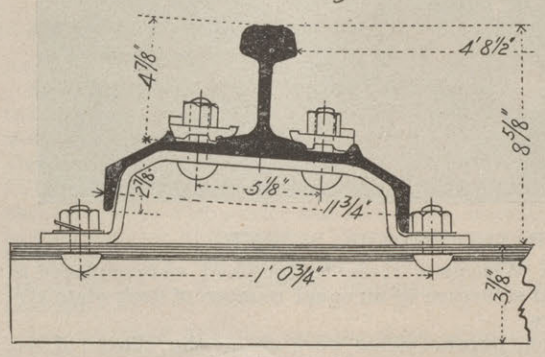


Fig. 4

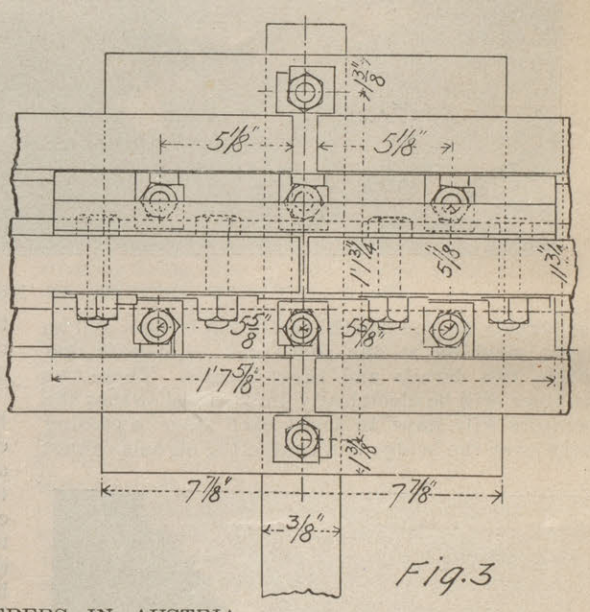


Fig. 3

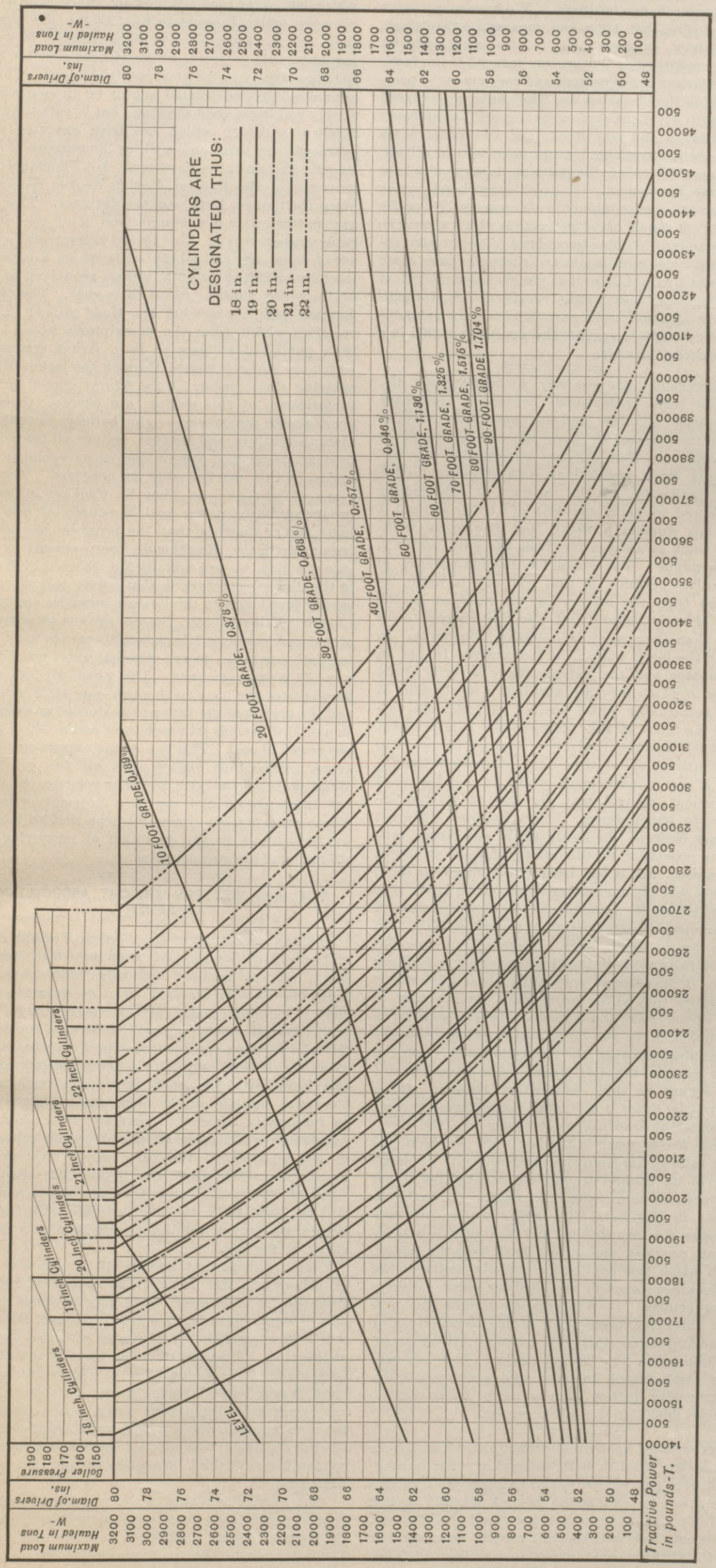
LONGITUDINAL SLEEPERS IN AUSTRIA.

The concluding remarks of the paper show that the increased service from the longitudinal construction is due to an absence of hammering of the superstructure on the ballast. The cost of maintenance is also referred to, and while the detailed figures are not of special interest, the comparative cost of the longitudinal and the cross systems will be. It is stated that the annual maintenance with the longitudinal system costs but 63 per cent of the expense of maintenance of the wooden tie construction. The concluding paragraph of the paper is as follows: "By slightly strengthening and widening our longitudinal sleeper and employing a rail about 5½ in. high, we should get a permanent way as strong as with the Goliath rail, and in many respects a superior one."

Engineers' Society of Western Pennsylvania.

At the meeting of the Engineers' Society of Western Pennsylvania held on September 20, 1896, Mr. Gustave Kaufman read a paper on "Hydraulic Power Transmission." After a brief history of the art of distributing hydraulic power from central stations to many consumers in cities in England, a short description of the plant of the London Hydraulic Power Co. was given. Formulae showing the method of calculating the amount of power in any given quantity of high pressure water were presented:

The purpose of the paper was then stated to be, to show the application of a hydraulic system to theuses of Pitts-



TRACTIVE AND HAULING POWER DIAGRAM FOR ENGINES WITH FROM 18 TO 22 IN. BY 26 IN. CYLINDERS.

burgh, claiming that with this system a relief from the smoke nuisance could be obtained. A description of a plant suitable for the present requirements of Pittsburgh was then given in detail. The pressure at which the water was to be distributed was assumed at 750 lbs. per square inch. The plant could deliver about 400 horse power continuously. There are two accumulators each 18 in. in diameter with 21 ft. stroke. The distributing mains were each 6 in. in diameter. The distributing system embraced the entire business part of the city.

The estimated cost of the pumping station was $100,000; distributing system $102,600; engineering and contingencies $27,400; total $230,000. The annual cost of operating including interest on cost of plant was $42,000.

The machinery to which the hydraulic power could be successfully applied was stated to be: first, hydraulic elevators; second, cranes; third, hydraulic intensifiers; fourth, fire hydrants; fifth, hydraulic engines. The principal use was for running hydraulic elevators. The paper contained a table showing the number of elevators operated directly from the city mains and the revenue of the city therefrom. It contained calculations showing that the average horse power furnished by the city for 102 direct pressure elevators was 51. It was shown in the paper that it would be cheaper for consumers to use high pressure water at the rates charged by the London Hydraulic Power Co. than what they pay at present.

Individual steam plants in the various buildings could by means of such a system be done away with and in that way reduce the amount of smoke now polluting the atmosphere of Pittsburgh. The claim was made by the writer, that engineers specifically employed for the purpose, could readily clear Pittsburgh of its smoke without hardship to anyone and that all that was required was for the authorities to pass and enforce rigid laws, thus making it necessary for manufacturers and business men to employ engineers and direct them to get rid of the smoke.

TRACTIVE AND HAULING POWER DIAGRAM.

In the Railway Review of October 10 a tractive and hauling power diagram was illustrated and it was mentioned that Mr. E. M. Herr, assistant superintendent of motive power and machinery of the Chicago & Northwestern Railway, had devised three such diagrams or charts, one for from 15 to 22 in. cylinders, with 24 in. stroke, and driving wheels from 48 to 80 in. in diameter, and with steam pressures from 150 to 190 lbs., one for engines with the same sized driving wheels and the same boiler pressures, but for cylinders from 18 to 22 by 26 in. stroke, and one for engines with the same sized driving wheels, but with boiler pressures of from 120 to 150 lbs. pressure and cylinders from 15 to 18 in. by 24 in. stroke. The accompanying illustration is for engines with cylinders from 18 to 22 in. in. by 26 in. stroke, and with boiler pressures from 150 to 190 lbs. per square inch, which is the second of the series in the order mentioned. This one is applicable to the heavy engines now in common use.

Perhaps in the explanation previously given the fact was not made sufficiently clear that the hauling powers given in this chart are not the starting powers but rather the capacities of the engines to keep trains moving after they are once started. The scheme was devised for the purpose of comparing locomotives upon hills with different grades with reference to their ability to haul a certain number of tons over them rather than to give a comparisons between engines in their ability to start the loads from a standstill. For convenience in reference, the following is reprinted from the previous description:

A glance at the diagram will show the loads hauled in tons as ordinates and the tractive power in pounds as abscissæ. The grades are laid out in straight lines at angles with the horizontal. At the upper and left hand portion of the diagram five horizontal lines give the steam pressures, and oblique lines show the different diameters of the cylinders. The main portion of the diagram is crossed by hyperbolas, of which there are five for each cylinder, one corresponding to each steam pressure. These curves are given in dotted lines in accordance with the key upon the right hand side of the diagram. It will be noticed that the hyperbolas are connected by vertical lines to the intersections of the oblique cylinder lines with the lines of steam pressures. An example will explain the use of the diagram.

The following formulas were used in constructing the diagram:

$$T = \frac{P L d_2}{D}$$

$$w = \frac{T}{2{,}000 \tan a + F}$$

in which

D = diameter of driving wheels,
d = diameter of piston,
F = friction per ton (taken at 6 lbs.,)
P = mean effective pressure (taken at 0.9 boiler pressure,)
T = tractive power in pounds,
w = maximum load hauled in tons,
tan a = tangent of angle of grade,
L = length of stroke in inches.

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CHICAGO, SATURDAY, OCTOBER 31, 1896.

ALL large users of iron and steel have been making more careful enquiry than usual among manufacturers relative to supplies and prices during the coming winter should supplies be desired. These inquirers have been so numerous and their sources so significant and respectable, that manufacturers have come to regard their chances for business with more favor. Some parties whose means of knowing more than the rest of us do not appear, are giving flattering estimates of the number of box and other cars that will be wanted surely in the new year; the number of miles of railway that will surely be built and the number of locomotive engines that will be ordered. There is joy in store for the steel makers if these estimates prove even approximately correct. The markets continue dull and uninteresting, and prices are weak. Manufacturers have named their figures on enough work to engage nearly maximum capacity for at least three months. We can only bide our time. The prospects are certainly encouraging for a great expansion in production.

AT THE present time there is a decided anomoly present in the question of the supply of freight cars. The demand for equipment is apparently much in excess of the supply available for immediate use, probably greater than could be met by the existing number of cars were they all in proper shape for service, unless, indeed, a material increase in the average car mileage per day could be made. It has for some time been evident that this demand for cars would materialize, as has been the case during the present month, and would show a large increase during the early winter months. As a result many companies early in the season ordered numbers of new cars, while at the present time the question of new equipment is being considered to a greater extent than for some years. The strange part of the situation is that many roads, some of which are thus contemplating buying new cars, have shut down their repair work, thereby keeping out of service a quantity of equipment that the expenditure of a comparatively small sum of money would render available. Just what principle of finance is responsible for this peculiar state of affairs would be an interesting subject for the student of economics. That it should be easier to get five hundred dollars with which to build a car than fifty dollars with which to repair a car already built, and for which the investor has already paid, may seem strange, but meanwhile our car building industries may congratulate themselves that such is the fact.

ONE of the difficulties which has arisen with the use of the new interchange rules is a general misunderstanding of the rule with regard to billing for wrong repairs. It is doubtful whether the members of the arbitration committee interpret the rule alike, and

> Who shall decide when doctors disagree,
> And soundest casuists doubt, like you and me.

The trouble will always be present to a certain extent until the millenium, when all the roads agree upon a standard car and use it and nothing else in interchange business, We have many years to live before that time, and meanwhile the delays, unnecessary expense and trouble occasioned by wrong repairs may be greatly reduced if the roads would observe the standards and recommended practice which they have set up. They have not followed these with sufficient care to prevent the use of many specialties in the way of material and attachments which are not available except in certain localities, or by manufacturing the parts on the ground where they may be wanted. A good thing should not be condemned because it is not in common use, but there are many items in car construction which should be made standard in order to conform to the present established recommendations and there are many more parts which might as well as not, be standardized. If the difficulties with wrong repairs do not of themselves bring about more careful adherence to standards, they ought to suggest the necessity of this in a very practical manner.

A CONTEMPORARY recently remarked upon the fact that while government control of stationary and locomotive boilers and the inspection thereof is very common among the more paternal governments of Europe, and that our own government has exceedingly strict regulations with reference to the use of marine boilers, the railways of this country are allowed to build any sort of a boiler and put it under any working pressure that they desire, without as much as a suggestion from the government in any particular. The reason for this indifference to locomotive practice is that no one is more interested than the officers of the railways in the safety of their boilers, and also that nobody knows better than they what is necessary for safety. In view of the large number of locomotives in use in this country and the extraordinary severity of the service in which they are working, it would seem as if the remarkably small number of explosions, attested the truth of this proposition. It is probable that much that the roads have learned in regard to safe construction of this kind has been at the expense of severe experience which in the absence of government control, may be said to be the incentive to improvement. There has been a marked contrast between the steam roads and street railways in providing for the safety of their employes and patrons, and it has been often urged in these columns that the increasing speed on the latter type of road should be accompanied by improvements in the direction of safe operation which has been seen in the case of steam lines. A needed improvement on such railways is in the direction of better braking power. Protection at drawbridges is another and it is believed that while government intervention in cases where protection is inadequate is a factor to be reckoned with in the future, progressive managers will set about earning the reputation with regard to safety devices that the steam roads have learned with regard to their locomotive boilers. It is evident that there is an increasing tendency to treat the matter of drawbridges seriously and the *Street Railway Review* records the fact that the Montreal street railway has been progressive enough to install at one of its bridges a complete interlocking signal and derail system from the works of Saxby & Farmer in England. The bridge tender operates the locks, the drawbridge and the signals and derails are provided eighty feet back from the bridge, which makes this application entirely similar to the interlocking protection provided for steam railways at drawbridges. It is interesting to note the progress which has been made in this direction and it is to be hoped that this good example will be generally followed in the United States. There is certainly ample reason to claim that such protection is a necessity rather than a mere improvement, however desirable the latter may be.

IT IS reported upon excellent authority that the engines of the English built steamship "Inchmona," which were guaranteed by the builders to furnish a horse power for 1.15 pounds of coal, actually burned only 1.07 pounds in propeling the vessel of 5,000 tons. This is not, however, the best record, as at another time the performance is stated to have been 0.999 lbs. of coal per horse power per hour. This is an astoningly low consumption, and is undoubtedly the lowest which has so far been attained anywhere. The boiler pressure under these tests was 225 lbs. per square inch. So far, there seem to be no difficulty in working under this pressure, which without question contributed largely to the good result obtained. This is not a specially constructed engine for the purpose of simply making a good showing, but is rather an example of a design which has been executed with extraordinary pains and skill for the purpose of continuous economical performance. Mr. Thomas Mudd, manager of the Central Marine Engine Works, of West Hartlepool, Eng., was the designer. This engine is fitted with five cranks, and is of the quadruple expansion type. The two low pressure cylinders are of equal size and all are centered on a straight line fore and aft of the ship, and all are driven by the ordinary link motion type of valve gear. The cylinders are jacketed by what Mr. Mudd calls an initial receiver, which from the descriptions which have been published appears to be a jacket system in which the steam is passed through the jacket before entering the cylinder. If the figures quoted for the performance of this engine are correct, there is every reason for marine engine builders to congratulate themselves, and for that matter, all interested in steam using may join in the encouragement furnished by this marked step in progress. The engines of the American liner St. Paul are stated to produce a horse power for 1.22 pounds of coal per hour; and as showing that the progress has not all been made in the direction of improvements in marine practice, we are told by Mr. Edward F. Miller in the *Technology Quarterly* that a duty test covering twenty-four hours on the Leavitt pumping engine at Chestnut Hill reservoir, Boston, showed an economy of one horse power on 1.15 pounds of coal per hour, and the coal per horse power of actual water work done was 1.34 pounds per hour. The steam per indicated horse power per hour on this test was 11.22 pounds, and the results of the boiler tests showed an evaporation of 11.07 pounds of water from and at 212 deg. F. per pound of coal. This is a triple expansion three-crank rocker type engine with all the cylinders steam jacketed and with a tubular reheater between the intermediate and the low pressure cylinder. These cases furnish ground for hope that all has not yet been done in the direction of improving the efficiency of the steam engine.

THE NEW WESTERN FREIGHT ASSOCIATION AGREEMENT.

The new agreement of the Western Freight Association, which is scheduled to go into effect November 1, markes another and what is perhaps, the most intelligently directed effort to maintain rates that is possible under present legislation. That it will from the outset accomplish all that is claimed for it is, perhaps, too much to expect, but that it will effect the desired object to a much greater extent than have any of the other agreements made since the act to regulate commerce became operative, may be reasonably asserted. Certainly, if the comprehensive view of the situation and the apprehension of the equities in the case which now prevail among the executives of the larger roads shall continue, there is little doubt that the new agreement will be found to be the best possible expedient to bridge the interval pending the repeal of the pooling clause of the law.

That in the present agreement, in common with all others of a like nature that have been adopted from time to time, weak spots may be found is not only evident, but to be expected. No good, however, will be accomplished by directing attention to them at this time. They will appear fast enough should occasion for their discovery arise. But on the other hand, it may be well to suggest that because of these very weaknesses the utmost possible care should be taken to maintain the atmosphere of confidence and the recognition of the rights of others, which is now so manifest and which has made the present agreement possible.

One particular clause of the new agreement permits of possibilities that leads to the suspicion that the framers thereof "builded wiser than they knew." The intention of the roads parties to the arrange-

ment is to effect by means of diversion of tonnage, so far as may be lawful, a division of business that will approximate the proportion of traffic to which each road is naturally entitled. This proposition is not in any sense new, but up to the present time there have always been difficulties in the way of effecting a satisfactory adjustment of tonnage by means of such diversions. A great many classes of freight do not readily lend themselves to such action. Many circumstances render it almost impossible to divert certain kinds of freight and it is revealing no secret to say that the recent conflict in the Western Freight Association was provoked largely because of this condition of things. But the new agreement provides, among other things, that the division of rates between parties to the agreement and between them and their connections, may be determined by the board of administration. The object of this clause was to put it within the power of the board to prevent the manipulation of rates by means of division, a practice familiar to all traffic men. But the possibilities of the clause and probably the principal use made of the power granted thereunder, will be to equalize tonnage between over and short lines by prescribing a joint rate and divisions by such lines.

Suppose for illustration the Burlington was over and the Santa Fe short on business from southwestern Missouri river points, but that when it was desired to equalize, the bulk of the current business of the Burlington was found to be of such a character as not to be easily divertible to the other road at the initial point. Formerly this would prove an almost insuperable obstacle, but under the power granted to the board of administration by the clause in question, they could direct that such business should be delivered to the Santa Fe at a given junction, say Fort Madison, Iowa, and prescribe the division of the through rate which should accrue to each road on such joint traffic. Such an arrangement, besides widening the scope of divertible freight, would preserve for each road its own business and more nearly conform to the spirit of the law than the former methods.

In the formation of the new agreement it would seem that in determining the number constituting the board of administration, the happy medium between an unwieldy body and an overloaded body had been struck. Too many members would have interfered with the dispatch necessary in some instances, while too few would have resulted oftentimes in a delay because of the number of subjects demanding attention. In the choice of the members of the board the territorial theory appears to have been made controling; a theory which it is hoped the lapse of time will prove to have been the proper one. So far as the gentlemen selected for the positions are concerned, no adverse criticism is to be made. With men so well versed in both the theory and the practice of traffic, and presided over by a chairman who, added to rare executive ability, is possessed of a knowledge of the entire situation approached by no one, the administrative part of the agreement will be well taken care of.

RAILWAY ACCIDENTS OF A YEAR IN ENGLAND.

Reports giving statistics in the form of long columns of figures usually make rather dry reading but this is not the case with the general report to the British Board of Trade upon the accidents that have occurred on the railways of the United Kingdom, during the year 1895, a copy of which has just been received. This report, written by Mr. Francis J. S. Hopwood and dated August 12, 1896, deals with railway accidents from two points of view viz: the safety of the traveling public and the safety of the men employed in working the traffic.

During the year there have been no serious accidents, and the number of passengers killed in England shows a decrease, although the number of persons injured is in excess of that of 1894. In 1895 only five passengers were killed from causes which were beyond their own control. The injured numbered 399, and these figures should be compared with 16 killed and 347 injured in 1894. These numbers, when compared with the total number of passengers carried enable a satisfactory estimate of the risk of death or injury to be made from train accidents. The proportion of passengers killed and injured to the number of passenger trips or journeys was only one in 185,954,182 killed and only one in 2,330,253 injured.

The accidents to passengers from causes other than accidents to trains, including those occurring through fault of their own have decreased from the number in 1894. In that year 101 persons were killed and 821 injured, as against 78 killed and 710 injured in 1895. In taking all the accidents on railways into account, the figures show one passenger killed out of 11,202,059 passenger journeys and one passenger injured out of 938,387. The journeys by season ticket holders are not included in these figures because the number of them cannot be estimated. The number of season tickets issued in 1895 was 1,196,827, and it is obvious that if an accurate estimate of the passenger journeys made by the holders of these tickets could be made, a large increase in the number of annual passenger journeys would be shown with a corresponding benefit to the passenger when calculating his liability to accident. The returns for the year are considered by the reporter to be favorable and, although a larger number of train accidents than usual were inquired into by the inspecting officers of the department, many of these accidents occurred with freight and mineral trains.

The inspecting officers have expressed the opinion that a proportion of the train accidents is attributable to negligence, want of care, or mistakes on the part of the officers and employes of the companies. But while it has been their duty to place the blame for certain disasters on the shoulders of those who were clearly responsible for them, the great service which the army of railroad employes gives to the country should always be borne in mind by the traveling public. When compared with the great mass of responsible duty to be performed, the errors of judgment on the part of employes are few and the absolute lapses from duty are almost infinitesimal. During 1895, the two sub-inspectors attached to the department, were almost continuously engaged in inquiring into cases of accidents to employes. In 285 cases the circumstances connected with the accidents were investigated locally in addition to which a large amount of correspondence was conducted in gathering complete information in regard to them. The board expresses the hope that as time goes on the adoption of the recommendations and suggestions made to the railway companies in the interest of the men will be found to have an effect on the number of accidents to them.

The Board of Trade is evidently much impressed by the record of the loss of life to the employes and the administration of the department has been specially directed to the consideration of methods of working which will conduce to the safety of the men. Important among the recommendations made to the road by the board, is that concerning the improvement of the lighting facilities in switching yards and other places where work is necessary at night. Attention has also been given to the regulations for and the modes of handling traffic, the covering in of interlocking connections and miscellaneous improvements to the permanent way. In the direction of decreasing the number of accidents to employes, the board urges the roads to provide special protection against the breakage of the gage glasses in locomotive cabs which is a source of a large number of painful accidents to locomotive crews. This subject cannot be passed over without suggesting that similar precautions are equally necessary in this country. The following figures taken from the report are interesting.

Of the 69 train accidents which were investigated the largest number occurred on the following railways: 9 on the Great Western, 6 on the Lancashire & Yorkshire, 5 on the Great Northern, 5 on the London & Northwestern, 5 on the Northeastern, 4 on the London, Brighton & South Coast, 4 on the Midland, 4 on the North British, 3 on the Caledonian, 2 on the Belfast & County Down, 2 on the Glasgow & South western, 2 on the Great Eastern, 2 on the Isle of Wight Central, 2 on the Midland & Southwestern Junction, 2 on the Southeastern. Not more than one of the remaining 12 accidents occurred on any one railway. Sixteen railway employes were killed and 331 injured while employed in coupling and uncoupling vehicles; 94 were killed and 1,127 injured while employed in various other switching operations; 12 were killed and 64 injured by being caught between vehicles; 9 were killed and 54 injured by falling or being caught between trains and platforms; 86 were killed and 95 injured whilst working on the permanent way and sidings; and 93 were killed and 148 injured while walking, crossing, or standing on the line on duty. The total number of railway employes killed and injured in the course of railway traffic, exclusive of accidents to trains, was 430 killed and 2,566 injured.

SOME OF THE ISSUES INVOLVED IN THE PRESENT CAMPAIGN.

When Mr. A. B. Stickney puts his pen to paper what he writes is well worth reading, irrespective of the acceptance or rejection of his views. He has lately published a pamphlet on the problems involved in the pending election which has called forth an editorial in the Financial Chronicle from which we extract as follows:

Mr. Stickney's purpose is to show that the issues involved in the election are not political but economic problems, and are matters that should not be subjects of legislation. For over thirty years the government has been attempting to create money, and to regulate, or at least affect values by acts of congress. The first false step—creating the greenbacks in 1862—taken under the specious arguments of a necessity, against the judgment of the ablest men, and then regarded as only a temporary expedient, opened the way to all the vagaries which have since grown up in the public mind. All these attempts at money making failed to produce the expected results. Money, Mr. Stickney points out, is a thing which cannot be made by law. Governments can coin money, but coining money is not making money. It is simply inspecting it as to weight and fineness. It is merely a police function, just the same as the government inspection of meat, milk, or any other commodity. Whatever is money after it has been coined was money before it was coined and would be money again if melted into bullion. Like all intelligent students of monetary affairs, Mr. Stickney thinks it is high time that the government should go out of the business of issuing imitations of money, whether in the shape of greenbacks, treasury notes or fifty-cent dollars, or warehouse receipts for the same.

He points out how greatly the use of money has been economized in various ways, not through legislation, but through necessity and intelligence. Among the principal labor-saving machines of commerce "which have maintained the supply by increasing the efficiency of money," he gives first and foremost place to the bank. The legitimate functions of the bank are creations of the natural laws, and legislation has no legitimate control of the functions of the bank, except to exercise a police authority to prevent fraud. Legislation cannot produce, and although it may hamper and change the form of the exercise, it can not destroy the banking functions. The banking functions existed before legislatures or governments existed, and they are immortal; they will exist forever. The bank check, by which transfers are effected without the use of a penny of actual money, is a greater labor-saving machine than any machine of production which has ever been invented. It was intelligence, not legislation, which discovered the use of the check. The bill of exchange is another device for economizing the use of money. It was the genius of invention, not legisiation, which produced the bill of exchange. The clearing houses furnish another illustration of how ingenuity can increase the supply of money by economizing its use. Telegraphic and cable transfers also increase the supply of money by economizing its use, and so do bank credits and boards of trade and commercial exchanges.

The truth is, it is not money that the United States needs, but capital. "What the people really want is more and better food, more and better clothing, more and better furniture, more and better houses, and more and better of all the necessities and luxuries of life. These are the things which are really desired instead of money. Legislation will not produce these things; neither will the free coinage of free silver produce them. All things which mankind really desires are held in that stingy grasp of nature which nothing but intelligent industry can loosen. Our minds are confused upon the function of money. Our most common forms of speech prove the confusion of ideas. We say it takes money to build houses, workshops, steam engines and railways. But I never saw a house built of money. I never saw a workshop, a steam engine, or a railway built of money. All the money in the world will not build a house. Houses are built of wood, or brick, or stone and other material produced by labor, and put in place by labor. While it is impossible to build a house of money, it is perfectly feasible to build houses without money and without using any money in, about, or during their construction." Again, it is common to have it said, "It takes money to become a merchant," when in fact the first requirement of the merchant is not money but capital. So, too, as regards the saying that "It takes money to build a railway." Mr. Stickney declares that he has converted millions of English capital into what is now the Chicag Great Western Railway, and that the Englishmen never sent to him, or to anybody for him, a single dollar of money. "The capital was transmitted by lightning on a cable under the sea, and was accomplished without the use of a dollar of money." England possesses vast stores of capital but little money.

In conclusion Mr. Stickney cautions the people against allowing themselves to be led to believe that the defeat of the free coinage party will bring immediate prosperity.

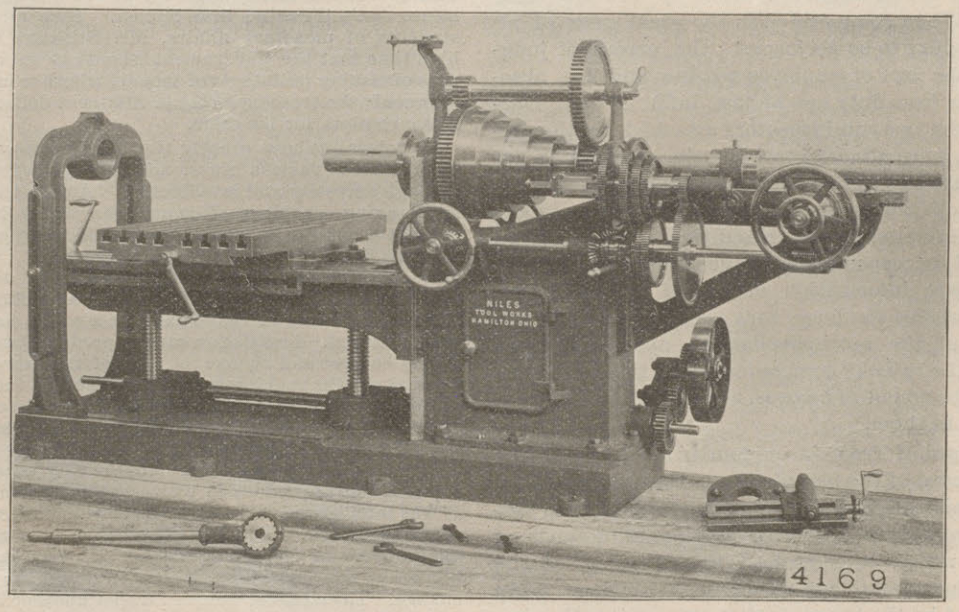
Like the repeal of the silver purchasing clause of the Sherman law in 1893 it is but one step. Like the repeal of that law, the defeat of free coinage will tend to prevent immediate disaster, but prosperity can only be gained by the slow and laborious processes of intelligent industry The defeat of free coinage will not even solve the money problem. One may not agree with Mr. Stickney when he asserts that "confidence in the slender thread which supports the value of the paper money which has been issued by the government has gone and will never return, but no one will take issue with him when he says that the money problem will never be permanently settled until the last dollar of fiat money is retired and the last vestige of the peculiar features of the American system of finance is destroyed.

The Civil Engineers' Club of Cleveland.

A semi-monthly meeting of the Club was held Tuesday evening, October 27, 1896, at the room in Case Library Building. Present, 57 members and visitors. Mr. Cecil L. Saunders read a paper entitled "Gas Producers and the Mechanical Handling of Fuel". The subject was presented under the following heads:—A discussion of various types —The necessity for attention to detail of construction—The relation of character of coal to type to be used—A possible field for future economy—Coal handling from hoppers—Unloading coal by mechanical devices.

HORIZONTAL BORING AND DRILLING MACHINE.

The accompanying illustration is reproduced from a photograph of the latest type of heavy horizontal boring, drilling and milling machine manufactured by the Niles Tool Works Company of Hamilton, O., and designated as their No. 2. The machine will bore to the center of a circle 60 in. in diameter. The boring spindle is of steel 4 in. in diameter and has a traverse of 54 in. The table is 6 ft. long and, as may



HORIZONTAL BORING, DRILLING AND MILLING MACHINE

be seen from the photograph it is supported by two heavy screws which are used for raising and lowering. Both of these operations are performed by belt power or close adjustments may be made by means of the ratchet shown in the foreground of the photograph. The table carries a saddle and a cross table providing compound movements. The outer end of the boring bar is supported by a yoke which is also designed for giving additional support to and clamping the outer end of the table. This yoke may be designed to accommodate special classes of work. The machine is furnished with a facing head. The boring spindle is provided with a quick hand traverse and also has four changes of feed operated by gearing. The feed may be reversed by means of a small lever plainly shown in the illustration. The driving cone has five speeds with a belt 3½ in. wide and with the back gearing gives ten changes of speed to the boring spindle. All the adjustments on both the feed movements and work are conveniently located within easy reach of the operator, which is a very important item when a large product is desired. All sliding surfaces in the machine are fitted by scraping and the workmanship and material used are the best obtainable.

Much criticism has been indulged in concerning the radical policy pursued by General Superintendent Hays, but even the Canadian papers now admit that the Grand Trunk, is a much more live institution than it has been for years, and maintain that there should be no feeling against the men who have made it so just because they are not Canadians.

STORAGE BATTERY TRACTION IN CHICAGO.

There is, perhaps, no improvement which may be secured in electrical engineering which compares in practical importance to-day with the production of a satisfactory storage battery. The problem of street railway transportation in the streets of crowded cities does not seem to be satisfactorily met by the overhead trolley, although up to the present time every other system employing electricity has given place to the trolley. For the purpose of a thorough test of the storage battery a double track road fifteen miles in length is being built, running from Woodlawn, Chicago, south to the town of Harvey, and a portion of the road between Woodlawn and Blue Island has already been constructed. A little less than a year ago all of the important storage battery interests in this country were consolidated under a trust, with headquarters in Philadelphia, with a view of producing a battery which should embody the best features of different types for the purpose of applying this principle to street railway operation, and this combination of battery interests has arranged for a test on the Englewood & Chicago Street Railway, which has a franchise providing for a right of way between Woodlawn and Harvey. The franchise provides for the use of horses, trolley, storage batteries or any similar power. As stated, a considerable portion of the track is finished, the power house is under roof and is fitted with temporary machinery sufficient for the operation of two cars, which are now making regular trips between Woodlawn and Englewood. Some of the officers of the eastern syndicate are directors of the road, but the two concerns are so separate that if the batteries fail to prove satisfactory they will be abandoned and the street car line will be run on the overhead trolley system. The construction of the road is under the charge of Mr. Herbert Condict as general manager and chief engineer, and the electrical work is in the hands of Mr. B. J. Arnold as consulting engineer.

Two cars are now running from the power house at South Englewood to the northern terminus of the line which is at Sixty-third and Vernon avenue. The present plans are to install 25 new cars, to be followed by 25 more when needed. The cars now running are for temporary use only and were brought from the Broadway line in New York. The new cars will have trucks specially designed for storage battery service, the battery being carried between the axles which are separated a sufficient distance to accommodate them. The battery will weigh 3,000 lbs. and will consist of 77 cells for each car. The cells are 18 in. high, 8 in. long and 5 in. wide, the battery having a capacity for 400 ampere hours which is sufficient to run 50 miles at each charging, the pressure being 150 volts.

The road is laid with 80 lb. rail upon 8 ft. ties at 24 in. centers and fitted with tie plates. The track is put upon a foundation of 6 in. of crushed stone, which was put in place after the use of a steam road roller over the road bed. The ballast is of crushed stone The power house equipment is planned with a view to reducing the cost of production of current to the lowest possible figures, and the steam plant will be of the highest grade with the water tube boilers fuel economizers, and triple expansion engines, all arranged with a view to using cheap fuel. The advantage to be derived in economy is expected in the low cost of the power house, the absence of overhead trolley construction and return conductors and the bonding of the rails, which is figured by the officers of the company as being a reduction of about 20 per cent below the cost of a trolley line. The cost of operation is expected to be about the same or a little below that of the trolley system.

The road begins at Sixty-third and Vernon avenue, beside the Alley Elevated tracks. In order to land passengers at a station of the elevated line, the street car company has bought up a right of way through the block from Vernon to South Park avenue, and will ultimately stop its cars along the sidewalk at the foot of the stairway leading up to the elevated structure. From Sixty-third street the route of the new road is straight south to South Chicago avenue, with a jog of half a block on Sixty-seventh street. On South Chicago avenue the battery cars fall in line with the trolley cars of the Calumet system, which leaves the Englewood and Chicago line at this point for a few blocks. When Seventy-first street is met, however, the route turns to the west and runs toward Auburn Park as far as State street, where it is within a couple of blocks of the Chicago City railway's trolley lines.

From Seventy-first and State Sts., the tracks run south along the newly paved thoroughfare. At Seventy-ninth street another turn is made to the west, until the Vincennes road is reached at the southernmost point of the city railway system. Except for a small twist to the west on Eighty-first street, where both the Chicago & Western Indiana and the Chicago, Rock Island & Pacific tracks are crossed, the general course of the line is then to the southwest along the Vincennes road to Western avenue in Blue Island. Then the latter street is followed south to the present terminus at the railroad crossing in the heart of the town.

A spur line, to act as a feeder, runs from the junction of the Vincennes road and Morgan avenue west on the latter street through Morgan Park. It ends at Mount Hope Cemetery, after skirting the edges of Mount Greenwood and Mount Olivet Cemeteries. Other feeders are projected to connect with various points in Englewood, Pullman, Kensington, Roseland, and Auburn Park. At present over twenty-one miles of track are laid. The officials of the company are as follows:

President, Mr. J. C. Shaffer, vice president, Mr. Walter Olds, general manager, Mr. G. Herbert Condict, secretary, Mr. Charles F. Griffin, and consulting engineer, Mr. B. J. Arnold.

ELECTRIC CAR LIGHTING.

A system of furnishing electric lights for trains has been brought out and perfected by the National Electric Car Lighting Co., of New York, and the success which has been met with in the applications already made, has attracted a great deal of attentions. The principles employed have been used quite extensively abroad and attempts have been made to work upon the same plan in this country, but none with the success of the system under discussion, which is patented both in Europe and the United States. The originator is Mr. Morris Moskowitz. It has been experimented upon and developed by the National Electric Car Lighting Co., to whom the success of the system is due. The chief claims made for it are a satisfactory light which is produced at a moderate first cost for equipment; simplicity of design of the apparatus; an arrangement which permits of easy inspection; one in which unskilled labor may be employed for attendance and the last and most important item is small expense for operation. The system has been thoroughly tried upon the Pennsylvania Railroad under exacting conditions and from all reports which have been received the claims seem to be substantiated. It is now being installed on a chair car running between Chicago and Kansas City on the Atchison, Topeka & Santa Fe Railway, and other applications are in prospect.

The light is obtained from a dynamo which is operated directly from the rotation of one of the axles of the car, and a surplus of current is obtained from a storage battery so that when a car is charged, at the time of the installation of the apparatus, sufficiently to furnish light for six hours, the dynamo will furnish additional current for keeping the lights burning from 10 to 12 hours a day during an indefinite period so long as the car is kept in running service. When sidetracked, standing in stations, or from any other reason the car is stopped, the accumulators will keep the lights burning for a period of 12 hours, and be ready for service at any time. The light is clear, steady and constant, whether the car is traveling at a high or low rate of speed or whether it is entirely at rest. The dynamo does not begin to generate current until the train has attained a speed of 8 miles an hour and the train speed is said to have no effect upon the working of the apparatus, and that

the lights are not effected by change of speed. The regulation is automatic and the apparatus is so arranged as to require inspection only at the terminal stations. The main elements of the equipment are a dynamo, a storage battery, which is furnished in duplicate, a switch board, and a lamp circuit in the car.

Fig. 1 shows a rear elevation of the car truck and also a half plan showing the method of attaching the dynamo and the driving mechanism. The dynamo is secured to the truck frame in the manner shown in this illustration and also in Fig. 2, which gives a half longitudinal section of the truck. The location

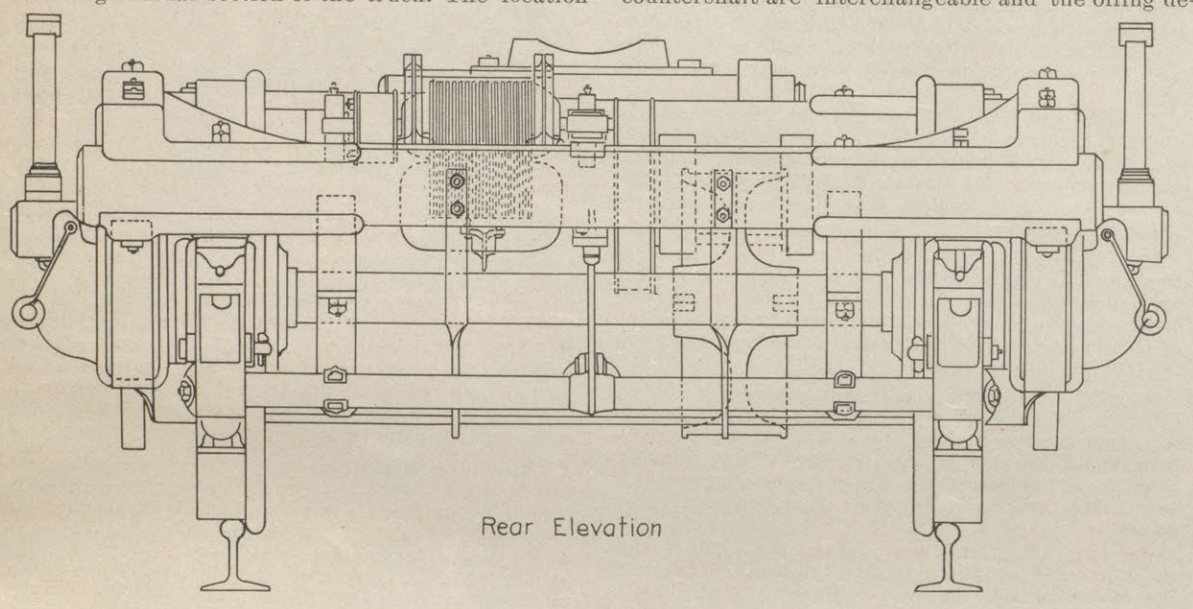


FIG. 1.—HALF PLAN AND REAR ELEVATION OF TRUCK SHOWING DYNAMO.

of the dynamo is such as to permit of easy access and it is so encased as to be entirely dust and moisture proof, which is an important matter. The transmission of power from the car axle to the dynamo is effected through a spring cushioned countershaft which is secured to one of the transoms of the truck. On the axle a split driving pulley is secured which is made of wood specially prepared for the purpose of withstanding the action of the weather and other severe conditions of service. From this driving pulley, a belt drives a pulley of the countershaft and the other pulley on the countershaft is belted to the small pulley on the dynamo shaft. These belts are both of double thickness and are specially prepared to withstand the weather and also to work under the severe conditions introduced by ice and snow.

The vibrations of the car axle are taken care of by a pair of powerful spiral springs attached to the bearing of the countershaft, which admit of the necessary vertical motion of the axle without putting additional strain upon the belt. The bearings of the countershaft are interchangeable and the oiling de-

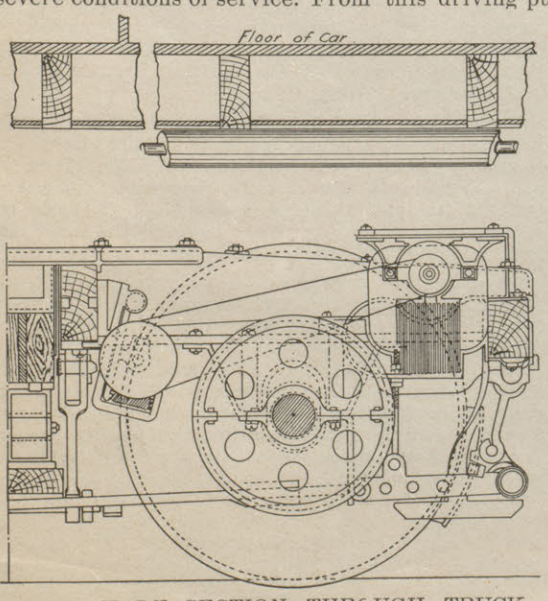


FIG. 2—HALF SECTION THROUGH TRUCK.

vices are such as to render it necessary to apply lubrication in the form of a heavy unguent only once a week. The bearings of the dynamo are also designed so as to carry a week's supply of lubricant, and the boxes are made with self-oiling rings to insure perfect lubrication. The brushes are manufactured specially for this service with a view of giving them a life of several months. The dynamo is self-regulating under the varying speeds of the train, and when running at 60 miles per hour, the current produced is only three volts higher than when the train runs at a speed of eight miles per hour. This important result is obtained by a new method of dynamo winding, for which the company referred to holds the patents. The wiring and the equipment of switches was designed with a view of placing the whole equipment in the hands of train men, and to minimize the attention which is required from them. To this end the switch board is provided with several automatic devices which are novel and interesting. A main switch controls every circuit pertaining to the dynamo, and this switch must be closed in order to cause the dynamo to generate current and if, for any reason, it is desired that the dynamo should not produce a current it is necessary only to open this switch. In addition to this, another simple switch is provided for the control of the main light circuit. In addition to these switches, a special 12-point switch controls the whole system, including the two sets of storage batteries already mentioned.

While one of these batteries is furnishing light, the other one is disconnected from the lighting circuit, and is charged by the dynamo, and when the battery that is furnishing the light is exhausted, the switch is turned into such a position as to interchange the connections between the batteries, so as to cut in the battery that is charged upon the lamp circuit, and to put the exhausted battery on the dynamo circuit. The switch is so designed as to permit these results to be accomplished by a single turn to prevent mistakes. The switch board also contains electro-magnetic devices by which the electric poles are changed automatically in accordance with the direction in which the train travels. Without this device, the system would not work satisfactorily, as the dynamo would only generate current in one direction, and it is evident that it must produce current in both directions in order to furnish light at all times. These automatic devices are very simple and consist of magnets and armatures carrying contact pieces which control the currents. Provision is also made for automatically opening and closing the main circuit, between the dynamo and the storage battery, by the difference in voltage existing between them.

The storage batteries are carried in two wooden boxes under the car and they are said to require looking after only once in several months. They are constructed on a new principle owned by the National Electric Car Lighting Company. The standard equipment for a 60 ft. passenger coach includes fourteen 16 candle power incandescent lamps, twelve of which are placed in the body of the car and one in each vestibule. The switches and automatic devices are arranged in a closet where they are easy of access and are protected from molestation by unauthorized persons.

From previously published descriptions it is learned that the dynamo and its auxiliary parts weighs about 300 lbs. and that the main driving pulley weighs about 35 lbs., this being the only weight of the apparatus which is carried directly by the axle. The aggregate weight of the batteries is about 1600 lbs. and the claim is made that this is the strongest and most permanent storage battery in use and it is also claimed that it is good for an uninterrupted service of three years before the positive plates require renewal. The following paragraphs are reproduced from a published account of the system as applied upon the Pennsylvania Railroad and which appeared under date of July of this year.

"A car equipped with tnis light has been in active service on the Pennsylvania Railroad for nearly two months, and has made up to this writing, over 6,500 miles without developing a single defect of the system. The train to which this car, No.944, is attached, leaves Jersey City at 6 o'clock p. m , daily, arriving at Philadelphia at 8:30, and returning from Philadelphia at midnight, arriving at Jersey City at about 4. a. m. This last train is advertised to stop between Philadelphia and Jersey City thirty-two times. Its running speed is, therefore, extremely low. Notwithstanding this fact, the light has been served uninterruptedly during the 6,500 miles, and after all this service the storage batteries contain now a larger charge than when the car started.

"Careful investigation made with this car shows that the additional power required to move the mechanism is so slight that it cannot be measured. At the same time it saves all cost and risk of the supply of oil or gas. while the light itself is the best that can be given. The company's storage battery and self-regulating dynamo give an even and constant supply of electric light, whether the train is running or stationary. Electric fans may also be run as a luxury in hot weather or in smoking cars."

The officers of the National Electric Car Lighting Co., are Mr. Theo. W. Myers, president, Mr. A. Sanford Adler, general manager, and Mr. Max E. Schmidt, C. E., vice president. The officers are at 30 Broad street, New York.

TECHNICAL MEETINGS.

The annual convention of the American Society of Mechanical Engineers will be held at the house of the society, 12 West Thirty-first street, New York City, December 1st to 4th, 1896. Secretary, F. R. Hutton.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m. at he Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

The Engineers' Club of Philadelphia meets on the first and third Saturdays in each month, at 8 p. m., at the house of the club, 1122 Girard street, Philadelphia, Pa.

The Civil Engineers' Club of Cleveland, meets on the second and fourth Tuesdays in each month, at 8 p. m., at the Case Library building, Cleveland, Ohio.

The Association of Engineers of Virginia, holds its in formal meetings on the third Wednesday of each month from September to May inclusive, at 8 p. m., at 710 Terry building, Roanoke, Va.

The Western Railway Club of Chicago, holds its meeting on the third Tuesday of each month.

The Central Railway Club meets on the second Friday of January, March, May, September and October, at 2 p. m., at the Hotel Iroquois, Buffalo, N. Y.

The Denver Society of Civil Engineers meets on the second and fourth Tuesdays in each month except July, August and December, when they are held on the second Tuesday only, at 36 Jacobson building, Denver, Colo.

The Western Society of Engineers holds its regular meetings for the transaction of business and the reading and discussion of papers on the first Wednesday of each month except January.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p.m., at the House of the Society, 127 East Twenty-third street New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each mouth, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West hirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the Vest Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumber and Publishing House, Nashville, Tenn.

The Railway Signaling Club holds its meetings in Chicago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, A. Sorge, Jr., 1533 Marquette building.

PERSONAL.

Mr. Oscar White has been appointed commercial agent of the Ft. Worth & Rio Grande Railway with headquarters at 506 Main street.

Mr. J. H. Maddy, railroad editor of the Commercial-Tribune of Cincinnati will take service with the Baltimore & Ohio on Nov. 1 as press agent with headquarters at Baltimore.

Mr. Holmes Cummings, a well known railroad attorney and representative in Texas of the Huntington interests, died last week in Memphis while on a visit to that city, which was formerly his home.

Mr. J. Judson Brooks, son of Mr. J. T. Brooks, of the Pennsylvania Lines, who has been in the offices at New Castle for some time has been promoted and goes to Cleveland to accept a higher position.

Mr. Frank Julian, formerly connected with the testing department of the Illinois Steel Company, has been appointed chief chemist of the Great Northern Railway system vice Mr. P. H. Conradson, resigned.

Mr. W. E. Fenner, who for many years has represented the Wagner Palace Car Company at the New York Central station, has resigned to accept the secretaryship of the Young Mens' Christian Association.

Mr. J. G. Pinkerton, master of transportation of the Kansas City, Memphis & Birmingham in attempting to board a train at Sulligent, Ala., one day last week, slipped and fell beneath the car, being instantly killed.

Mr. C. Kadono is now engineer of construction of the Sanyo Railroad, Japan, with headquarters at Hiroshima. Mr. Kadono was formerly in this country, being employed in the engineering department of the Pennsylvania Railroad.

Mr. Dennis F. Maroney, chief of the car record service of the Baltimore & Ohio has been appointed superintendent of transportation of the company with office in Baltimore. The office is a new one and the appointment takes effect November 1.

Mr. D. O. Ives, general freight agent of the Chicago, Burlington & Quincy announces the appointment of Mr. Howard Elting as traveling freight agent to succeed Mr. R. K. Smith, promoted. Mr. Elting's headquarters will be Brookfield, Mo.

Mr. James Garvey, traveling passenger and ticket agent for the Wabash Railway, and one of the most widely known railroad men in the west, died at Moberly, Mo., October 26, aged 56 years. Mr. Garvey's death was caused by apoplexy.

Mr. S. S. Murphy, secretary to Chief Engineer Kittredge of the Cleveland, Cincinnati, Chicago & St. Louis, has tendered his resignation and will take service with the Illinois Central as chief clerk to Superintendent King with headquarters at Jackson, Tenn.

At a recent meeting of the directors of the Chicago, Montello & Northwestern Railway, the organization of which we noted last week, the following officers were elected: President, J. L. Pennifill; vice president, C. E. Pierce; treasurer, A. K. Welles; secretary, E. W. Underwood.

Mr. Frank Shaw, chief clerk in the passenger department of the Peoria, Decatur & Evansville Railroad, was stricken with apoplexy in his office at Evansville last Monday, and died shortly after without regaining consciousness. He went to Evansville two years ago from Indianapolis.

At the annual meeting of the stockholders of the Maine Central Railroad Co., held at Portland October 21, Mr. Joseph H. Manley was elected a director to fill the vacancy caused by Mr. Francis W. Hill's resignation. Mr. Manley is one of the leading, best known and successful business men of Maine.

Mr. J. M. Wallis, superintendent of motive power of the Pennslyvania road, who is now on a hunting trip, will, on his return, be treated to a pleasant surprise in the shape of an appointment as general superintendent of the Philadelphia & Erie and the Northern Central roads to succeed the late Mr. Robert Neilson.

Major T. J. Peter who was general manager of the Gulf Colorado & Santa Fe Railway years ago, died at Brierfield, Ala., Oct. 23. For the last ten years Major Peter has been general manager of the Briarfield Coal & Iron Company, one of the largest manufacturing companies in Alabama. His remains were interred at Selma, Ala., last Saturday.

Mr. J. P. Magill has been appointed division freight agent of the Pittsburgh & Western Railway, in charge of the Mahoning and Shenango valleys, with the lines to Akron and Fairport inclusive, and will have his headquarters at Youngstown. Mr. Magill was formerly with the Cotton Belt Line, and has been contracting agent of the Pittsburgh & Western in Pittsburgh.

At the annual meeting of the Superior Terminal & Transfer Company held last week at St. Paul, General Manager J. W. Kendrick of the Northern Pacific was elected president of the company to succeed Mr. W. F. Fitch of the Duluth, South Shore & Atlantic. Mr. W. C. Farrington of the Eastern Minnesota, was elected vice president to succeed Mr. Kendrick. The election of a secretary and treasurer was postponed but it is generally thought that Mr. D. A. McKinlay, who now holds that office, will succeed himself.

Mr. W. W. Atterbury, master mechanic of the Pennsylvania Company shops in Fort Wayne, has been appointed superintendent of motive power of the Pennsylvania Railroad lines between Pittsburgh and Philadelphia, with headquarters at Altoona. This is deserved promotion, as during the six years he has had charge of the Fort Wayne shops he has made a good record. It is not known yet who will secure the vacancy, but the names of Mr. Barney Fitspatrick, of the Columbus (O.,) and Mr. Thomas Butler of the Wellsville shops have been mentioned in this connection.

On Wednesday, October 21, occurred the death of Hon. Harvey Wells at Wellston, Ohio. The Toledo Blade says: "The deceased was well known in railroad circles generally and it was through his untiring efforts that the Wellston & Jackson Belt line was carried to a successful completion. At the time of his death, Mr. Wells was interested in the project of a new road to extend between Wellston and Cincinnati, which was to be known as the Wellston, Hillsbore & Cincinnati. It was while connected with this work that he was taken with a sickness which has finally resulted in his death. Perhaps no other man of Jackson county was held in such high esteem by the residents as Mr. Wells, and in the railroad world he was regarded as a man of great ability and enterprise."

RAILWAY NEWS.

Chicago & West Michigan—A circular to the bondholders of the Chicago & West Michigan and Chicago & North Michigan Cos. was issued from the treasurer's office stating that no permanent improvement in business having taken place the directors would again be obliged to offer to the holders of coupons maturing November 1 and December 1 respectively, one-half of the amount of their conpons in cash and the other half in scrip of the company, to be called "Coupon Scrip," payable in ten years from date with interest at 5 per cent per annum, payable semi-annually, the company reserving the option to prepay the scrip at any time on 60 day's notice, or to buy the same in the open market at any time, and agreeing that no dividends shall be paid on the stock until the company shall have paid or offered to pay all the said coupon scrip. A similar arrangement was made last spring for holders of bonds maturing May 1 and June 1 respectively.

Des Monies & Kansas City.—On Nov. 1, the Des Monies & Kansas City road, which is 72 miles in length and extends from Des Monies to Van West, Iowa, will be converted from a narrow to standard gage. This line is now in control of the Chicago, Burlington & Quincy.

Greenwood, Anderson & Western.—Mitchell & Smith, the attorneys for Messrs. B. W. Strang, Jr. & Co., of New York, who have the contract for the construction of the extension of the Greenwood, Anderson & Western have made application for the appointment of a receiver for the road. Strang & Co., claim that the railroad company ha violated the contract in several ways, and that the money for parts of the road already built has not been paid. It is understood that the road claims that the violations of the contract have been on the part of Strang & Co. The prayer asks that the lease of the Carolina Midland road to the Greenwood, Anderson & Western be included as part of the property of the latter line. Judge Simonton issued a rule against the road to show cause on November 5 why the receiver should not be appointed. The extension in question is from Sievern to Batesburg in South Carolina, and is about 15 miles in length, 12 miles of which is graded and 6 miles of track laid. It is expected to complete the work by November 15. It is also the intention to build an extension from Batesburg to Greenwood, 40 miles. Chief engineer, Thomas B. Lee.

Jacksonville, Tampa & Key West.—The sale of the Jacksonville, Tampa & Key West road advertized for Nov. 2 is again postponed until the first Monday in March 1897. This order by Judge James W. Locke of the United States court as per petition of the complainant "on account of the disordered condition of the money market."

The upset price fixed by the court is $350,000 and the property is subject to a lien of $2,212,000, the amount of the first mortgage bonds secured by a mortgage deed held by the Mercantile Trust Co. of New York. All of the property will be sold as an entirety, and every bidder must first deposit the sum of $25,000 with the masters, Charles S. Adams and Dennis Eagan, in cash or certified check on a responsible bank. The sum of $350,000 must be bid and paid in cash before confirmation of sale and delivery of the property for the purpose of paying receiver's certificates, unpaid operating and court expenses and costs due.

Louisville & Nashville.—Extensive improvements are now in progress along the line of the Louisville & Nashville road in Alabama. It is expected that about $400,000 will be expended in handsome passenger and freight depots. At Pensacola improvements which are to cost $35,000 have been begun. The proposed improvements there are in the nature of repairs on warehouses, elevators, wharves and the like, and more than 300 men are now at work there. The travel over the Alabama lines of the Louisville & Nashville this year has been phenomenally good.

The company is also said to be contemplating an extension to the Pineapple division which connects Selma and Pineapple, to reach the Florida state line about 15 miles distant. A logging road of standard gage will be utilized. Mr. R. Montfort, Louisville, Ky., is chief engineer.

Minneapolis, St. Paul & Ashland.—A purchase has been made by the Minneapolis, St. Paul & Ashland road, of the Shores' mill site at Ashland, thus obtaining one of the finest freight docks on Chequamegon bay. The dock has shore width of 1,498 ft. and extends into the bay as far as the docks. The Minneapolis, St. Paul & Ashland road was organized in the early part of 1895, and is projected to run from Ashland to Taylor Falls, a distance of some 125 miles, at which place connection will be made with the "Soo" line. The officers are Messrs. J. W. Cochran of Ashland, president, Chas. H. Pratt, of Minneapolis, secretary, and J. S. Ellis, of Ashland, treasurer. Capital stock, $2,500,000.

New York & Northern.—The court of appeals at Albany, N.Y., has rendered a decision whereby the stockholders of the New York & Northern R. will get a new trial in the lower courts to test the foreclosure of the mortgage held by the Farmers' Loan & Trust Company, under which foreclosure the New York Central purchased the road. The judgment of foreclosure and the sale is reversed and a new trial ordered, to allow the minority stockholders to present to the court charges that the Central road after purchasing $1,700,000 worth of stock purposely aided in forcing the foreclosure so that it might get rid of a rival, and the further charge that the earnings of the road were purposely misapplied so that the foreclosure might be forced. The lower court decided that it was not illegal on the part of the Central to force liquidation, but on the appeal of several of the minority stockholders the case is ordered retried.

Norfolk & Western.—The date of sale for the Winston & Salem division of the Norfolk & Western road has been set for November 24, at Winston, N. C. No bid for this branch, which is 16 miles in length, less than $500,000 will be considered. Messrs. Bowden and Sharp are special masters.

The Scioto Valley division is also to be sold under foreclosure at Portsmouth, Ohio, on November 11. This division is 131 miles in length and extends from Columbus to the Ohio river.

Oregon Short Line & Utah Northern.—The first important step looking to the sale of the Oregon Short Line & Utah Northern and its separation from the Union Pacific system was taken Oct. 28, when the American Loan & Trust Co. filed its application for permission to foreclose and sell the road. The road will be bid in by the bondholders and the reorganization plan will be put into operation.

Olean, Bradford & Warren.—In July last, the Western New York & Pennsylvania having built a curve on its Oil City division to form a connection with the Buffalo, Rochester & Pittsburgh whereby to run its trains through Olean, the Olean, Bradford & Warren road, 23 miles in length, was practically abandoned by the first named company. Since that time various rumors have been in circulation in regard to the ultimate disposition of the property. A syndicate of Boston capitalists has been looking the ground over and has had some talk with the railroad people, but it did not seem likely that the talk would have any definite result. But last week, while on an inspection trip over his road, President De Coursey of the Western New York & Pennsylvania road, met the representatives of the Boston syndicate, and although the meet-